NATIONAL ENERGY STRATEGY
(Part I & II)

HEARINGS

BEFORE THE

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SCIENCE, SPACE, AND TECHNOLOGY
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NATIONAL ENERGY STRATEGY

TUESDAY, FEBRUARY 26, 1991

U.S. House of Representatives,
Committee on Science, Space, and Technology,
Washington, D.C.

The Committee met, pursuant to notice, at 10:32 a.m., in room 2318, Rayburn House Office Building, Hon. George E. Brown, Jr. [Chairman of the Committee] presiding.

The Chairman. The Committee will come to order.

We have the very great pleasure and privilege of having the Honorable James T. Watkins, Secretary of the Department of Energy, here this morning. The Chair will point out to all the members that we have before us some excellent materials, including the Energy Policy material prepared by the Secretary, and other materials which, if the Members of the Committee would really absorb it all, would make them extremely wise and intelligent.

The Chair is also going to suggest that we limit our opening statements as much as possible, and the Chair will set a good example by putting all of his very profound words in the record, leaving time for others to make brief statements if they wish. Hopefully, they will limit. That will mean we will be able to devote most of our time to hearing from the Secretary and addressing questions to him. The Chair will likewise continue the policy of trying to recognize members in the order in which they appear at the Committee.

The Chair will recognize a Republican spokesman.

Mr. Sensenbrenner. Mr. Chairman, first I ask unanimous consent that the opening statement of our distinguished ranking member, Mr. Walker, be put in the record at this point.

The Chairman. Without object.

Mr. Sensenbrenner. Secondly, I will be brief in about 25 words or less. I would like to welcome the Secretary here. What he is going to be talking about is going to be very critical in terms of setting our energy agenda in the post- Gulf War economy. The post-Gulf War, hopefully, will be relatively soon.

I would hope that he and many of our friends in the press don't forget that Congress does not have the power to repeal the law of supply and demand, much as some of us would like to do that. And while this Committee has spent quite a bit of its time in the last ten years looking at various alternative energy sources, one of the reasons why they have not become more readily used is because the price of oil has been a much cheaper and cost-efficient source of energy rather than some of the renewables and more experimental programs that we have funded through our authorization power in the Department of Energy and elsewhere.

I don't think that a National Energy Policy that ignores the law of supply and demand is going to be accepted by the American people; they are going to be looking for what's the cheapest way to pay their bills. At the same time, I do think that we ought to diversify the eggs in our energy basket, and I hope that the Secretary has some rather good thoughts along those lines.

Thank you.

The **Chairman**. We appreciate those wise words.

I'll recognize Mr. Scheuer, the distinguished Vice Chairman of the Committee.

Mr. **Scheuer**. I thank you, Mr. Chairman.

Admiral Watkins, "by no means can George Bush's Energy Policy experts be proud of their draft since the plan does not concentrate on saving energy but on increasing supplies. Despite the oil shocks of the 1970s and 1980s, the market economy is still the leitmotif of the U.S. Energy Policy, if there is such a policy. But this policy has made the United States dependent upon imports and strangled its own production." Admiral, these aren't my words, the words I just spoke were an editorial, a recent editorial from the very moderate, thoughtful newspaper the "Suddeutsch Zeitung." This is what they feel, and I read directly from their editorial page and I'll be reading excerpts from other prestigious newspapers—

The **Chairman**. Is that a New York newspaper, Mr. Scheuer?

Mr. **Scheuer**. No, but it's from the land of my forefathers, so I respect it; and it is a newspaper that is internationally respected.

Admiral Watkins, you are one of the stars of this Administration and you are one of the finest public servants I have ever had the pleasure of meeting in 25 years of service in this body. You are truly a formidable leader and thinker. And it just pains me beyond belief that the very excellent draft of a National Energy Policy that you sent up to the White House, a thoughtful, creative, constructive draft that had a fine place for energy conservation, that gave dignity and true consideration to energy efficiency, and gave depth and true consideration to alternative sources of fuels, I am sorry that that met the treatment of a team of surgeons and they didn't take the surgeons scalpel to it, they took the meat axe to it. If I had to name the surgeons, it wouldn't be difficult—Sununu, Darman, for starters. It is a source of deep regret to me. I hope one of these days they will liberate you and let you exercise the high intellectual power that you have given the Government, the thoughtfulness, the vision of the future so that you can really fulfill your vast capability in devising constructive and thoughtful energy policies for our country.

I thank you, Mr. Chairman.

The **Chairman**. Thank you, Mr. Scheuer.

Mr. Boehlert, are you going to enlighten us with a brief statement?

Mr. **Boehlert**. I will, Mr. Chairman.

The **Chairman**. The briefer, the more enlightening it will be.

Mr. **Boehlert**. All right. I thank you that, and I will ask permission that my entire statement appear in the record at this point.

The **Chairman**. Without objection.

Mr. **Boehlert**. But at the risk of appearing to be a New York cabal, following on what my colleague Mr. Scheuer has said, I would like to say to you, Mr. Secretary, that the draft proposal before us falls under the heading of "expectations unfulfilled." Never have so many had reason to expect so much from so few and been so greatly disappointed.

Now, having said that, let me also say, as my colleague Mr. Scheuer did in a spirit of bipartisanship, that I am here to help you. And I think you are one of the good guys. I think your battle is not with us; your battle is with the Office of Management and Budget. I look forward to your testimony, I look forward to the opportunity to pose what I think are some pertinent questions to you, and to working with you to develop what the Nation really needs, and that is a National Energy Policy that makes some sense for the future.

Thank you, Mr. Secretary.

The **Chairman**. Thank you very much, Mr. Boehlert.

And now it gives me great pleasure to recognize our distinguished chairperson of the energy subcommittee, who has probably devoted more time and effort to this than any other member of the committee, Admiral, and I am sure you have encountered her wisdom over the years that you've been here, Mrs. Lloyd.

Mrs. **Lloyd**. Thank you very much, Mr. Chairman. I ask unanimous consent that my entire statement be a part of the record.

The **Chairman**. Without objection.

Mrs. **Lloyd**. Admiral Watkins, we welcome you today, as we do your distinguished Assistant Secretary Henson Moore. I think you will recall that when you assumed your office as Secretary of Energy that I said that you had a very distinguished career in the United States Navy but you would do our country no greater service if we devised a National Energy Policy. And we're here today finally to roll up our sleeves and tackle the difficult business of building this comprehensive energy policy, which you know is certainly long overdue. We cannot throw away or discard any energy technology; Mr. Secretary, we need them all in a balanced approach if we're going to meet our needs for the 21st century.

Although we have areas of controversy, I do want to commend the Department of Energy for their efforts to tackle finally this very difficult issue. It is a thankless task for you and I think that we all knew there would be dissent and disagreement with whatever plan that was devised. For nearly two decades now we've been debating and arguing over energy policy without any results. So, I would hope that this strategy, although many of us in the room have difference of opinion, would serve as our base upon which we can finally work to build a long-term energy strategy that our Nation certainly needs.

Thank you, Mr. Chairman.

The **Chairman**. Thank you very much, Mrs. Lloyd.

I am going to recognize other members who have important contributions to make, and I know of at least one. Mr. Smith, I recognize you.

Mr. **Smith**. Thank you, Mr. Chairman.

Mr. Chairman, while I congratulate the Administration on its initiative to create a National Energy Strategy, I have concerns that the strategy does not adequately address the concerns of the independent oil producer. I realize the National Energy Strategy is a jumping off point but it offers little support for the independent producer who accounts for 41 percent of our domestic production in the lower 48 States. The opening of the Arctic National Wildlife Refuge and the Outer Continental Shelf, though needed, does not address the need to rely more on the surest, environmentally safest production of the U.S., that of the lower 48 States.

The strategy places emphasis on developing new technologies to recover oil left behind by conventional oil production methods. Yet, the President's own budget cut research and development for fossil fuels in half.

Also omitted from the strategy were tax incentives to encourage domestic exploration and production of oil and natural gas. We need a much stronger commitment from the Administration for the domestic production of oil and gas by the independent producer.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. Smith.

The Chair will be glad to recognize Mr. Wolpe, if he wishes. Mr. Wolpe is the new Chair of our Oversight Subcommittee, Admiral, and he will have a mission to keep on your back if necessary.

Now the Chair repeats its welcome to you, Admiral, and to your colleagues, our distinguished former colleague Mr. Henson Moore, and we also welcome Linda Stuntz from your Department.

The floor is yours.

STATEMENT OF HON. JAMES D. WATKINS, SECRETARY, DEPARTMENT OF ENERGY; ACCOMPANIED BY: W. HENSON MOORE, DEPUTY SECRETARY, AND LINDA STUNTZ, DEPUTY UNDER SECRETARY

Admiral WATKINS. Thank you very much, Mr. Chairman.

As you know, the President issued the charter for the National Energy Strategy on July 26, 1989. During the ensuing 18 months we've held 18 hearings, we've had 448 witnesses come before us, we've covered representatives from 46 States, and we've received 2,000 serious written submissions. The Interim Report that we submitted in April of 1990 was merely a compendium of public comment to scope the breadth and depth of the issue surrounding an attempt to build a National Energy Strategy that's integrated and comprehensive.

Following that set of hearings, we conducted seven months of intensive inter-agency analysis, and that was done through the President's Economic Policy Council, which is basically a council made up of representatives from, in this case, 16 different Federal agencies. We held five EPC cabinet meetings, two of them with the President, and I've had private sessions with the President.

One of the things that has come out of this I think is that we need to recognize, and particularly with this committee, that we have a comprehensive analysis to back up the Strategy. Never before have we had the integrated analytic underpinnings that would support the complexity of issues that we have, and that we must deal with these then in a comprehensive way. This will be hard up on the Hill, with so many different committees we have to go before, to be able to say that if you want to insert something in this Strategy, then let's agree on the analytic approach to see how it interfaces with all other elements. And I think one of the tragedies of the past 20 years, that we talked about as "no energy policy", is the very fact we have been unable to do this for whatever reason. And I think now we have to start taking these individual items and say, fine, let's look at that in balance with other alternatives that we have placed in this strategy in integrated fashion. And we can show you and we will share with you that analytical base, and hope that we would be able to find new harmony and dialogue on many of these very contentious issues which have faced the Congress for many, many years, and some of which are still not resolved, much as the situation pertained in the Clean Air Act debates.

We believe as a result of all of this, that we've accomplished our mission given to us by the President and we've laid a foundation for the future. We believe embodied in this Strategy are powerful ideas for America's future. One thing we found that there simply is no single, simple answer to America's energy challenges. It is nice to have a simple solution, but there wasn't any in our deliberations. This comprehensive and balanced Strategy includes nearly 100 ideas, but those ideas here are converted to initiatives: It is an action program affecting virtually every aspect of the way we produce, use, and transport energy.

Now, I would like to review some key elements, and I would like to refer to a variety of figures, which you have both in front of you and we have displayed for both those in the room as well as those in the dais. The reality is the United States and the rest of the world will continue to rely on oil for the foreseeable future and Persian Gulf producers will remain critical players in the oil market.

Now, figure 1, which you have before you now, on the ordinate there you see millions of barrels per day against time, with 1990 in the middle, where we've been in the past, where we're going in the future. I want to explain this and I won't have to do it on many graphs then. What you're seeing on the right side of 1990 are the projected supply and demand situation reflecting oil imports and total oil production.

The current policy base is that base defined in Appendix C to the Report. And it is important that we all know what's in that base. Basically, it is everything that is in law, in regulation today, on the books and projected, except for Clean Air Act, and this bill and a couple of other items. But I do think it's important we know what we're talking about here. We found it was very important to integrate Clean Air Act as a module, very important module, in this Strategy because of the interlocking relationship between clean air and everything we're trying to do in a long-term energy strategy.

So, at the top there in the heavy blue, you see oil imports and where they might have gone without the Strategy by the year 2010. You also see down below the total U.S. production enhanced by the Energy Strategy options that we have in it. And then to the degree you see the vertical white lines there on the lower lighter blue out there beyond 1992 or 1993, that's the representation of the uncertainties of the actions. In other words, the optimistic as opposed to the somewhat very conservative. We think that's a reasonable range of expectations out there for the American people.

Now, what this figure 1 illustrates is the fact that the NES attacks the challenge of increasing energy security in a balanced way. It reduces our need for oil by 3.4 million barrels a day by the year 2010, and it increases domestic supplies of oil by 3.8 million barrels a day by the same year.

On the demand side, the aim of the NES is to introduce alternative fuels and technology, expand the use of domestic natural gas, and increase the efficiency of all our vehicles. And we do this by using alternative fuels in fleet vehicles; accelerating research and development on electric, gas turbine, and fuel cells propulsion systems, and on high efficiency conventional engines; by intensifying R&D on more efficient industrial processes in aircraft bodies and engines; by scrapping older cars; increasing ride-share commuter benefits; and wider use of intelligent vehicle highway systems.

On the supply side, the aim is to use superior production technology and environmental safeguards to increase domestic production, including: advanced research and development for enhanced oil recovery technologies, access to a discrete portion of the coastal plain of the Arctic National Wildlife Refuge, and access to certain portions of the Outer Continental Shelf.

Now let's talk about the international aspects, which are critical to this element of the Strategy. The NES proposes diplomatic and trade initiatives to expand production capacity in areas outside the Persian Gulf, mainly in the Western Hemisphere, Europe, and developing nations, and to expand their strategic stocks.

Now, turning next to another issue. I would like to talk about what will the NES accomplish now regarding energy imports. As you know, we have been importing about 8 million barrels of crude oil and refined products per day, which is nearly 13 percent of total daily world oil production. By reducing our consumption, we reduce our imports and, hence, the demands we place on the world market. This reduces our vulnerability and that of our allies to disruptions in world markets.

This slide here shows that in less than 20 years without the National Energy Strategy, imports would rise to approximately 65 percent of domestic consumption. Working with tandem with other Administration initiatives, the National Energy Strategy proposal will reduce our oil imports by 3 million barrels a day in the year 2000, almost 6 million barrels a day by the year 2005, and 7 million barrels a day by the year 2010, and basically hold it then at the 40-45 percent level, with a degree of uncertainty shown in the vertical line.

Additionally, the important regulatory reforms contained in the National Energy Strategy for the natural gas market will expand U.S. fuel-switching capabilities and increase the Nation's flexibility to respond to unforeseen events in the oil sector.

Now, what will the Energy Strategy accomplish regarding energy efficiency and conservation; that's the focal point of a great deal of attention so far on the Strategy. We've made great strides in the last two decades to improve energy efficiency. We power an economy 50 percent larger than the 1973 economy with only 7 percent more energy. The NES will do much more, as evidenced by the trend lines in figure 3. What you see on this chart, on the vertical are quads of energy—and noted there is that a quad of energy is equivalent to about one-half million barrels a day over one year. That's a large amount of energy. The Nation consumes in total energy about 80-85 quads today. That gives you a feeling of what we're talking about when we talk about 4 or 5 quads; a significant amount of energy against a total national utilization.

The zero line merely means that that is what I referred to earlier as the current policy base normalized then to that base so we can see what differential the National Energy Strategy imposes on both the primary energy supply—that's all forms of energy—and primary energy demand reduction. As shown on this slide, the National Energy Strategy will result in a reduction of total primary energy demand by 7.5 quads by the year 2010, and by nearly 13 quads in 2020, and by more than 17 quads in the year 2030 from the current policy base case, and mostly in the electricity sector.

These proposals include enhanced competition in the generation of electricity while protecting consumers; reform of hydropower and nuclear licensing, and extensive reform of the natural gas regulatory regime; encouraging efforts to remove regulatory disincentives to utility investment in energy efficiency; tax free treatment of utility rebates to consumers for efficiency investments when provided as rate discounts; cost-effective appliance and equipment standards; and expanded testing and labeling for lights, motors, and other equipment; expanded mortgage financing incentives for energy efficient homes, more energy efficient public housing, and stronger building standards; accelerated research on more efficient building technologies and industrial processes; enhanced R&D to develop more efficient and less polluting electricity generating technologies, including renewables, nuclear, and clean coal; removal of disincentives for use of waste minimization technologies.

And as figure 3 shows, the National Energy Strategy will make us substantially more energy efficient. By the year 2010, the NES will have the effect of reducing energy demand by 7.5 quads, as I mentioned earlier, while energy supply will increase by only 4.3 quads. Said another way, the NES will leverage projected energy demand reduction at nearly twice the rate of projected energy supply increase by the year 2010. This differential is even greater thereafter.

I would like to turn to the next figure and ask what will the NES accomplish regarding energy and the environment. In this slide, we see that the National Energy Strategy will bring environmental and energy objectives into harmony. The National Energy Strategy measures that improved air, land, and quality include increased use of cleaner burning fuels and technologies such as natural gas, nuclear, and renewable energy; development of model programs for siting energy facilities; and minimization of waste. And as you can see on this slide, we're projecting there a potential for global warming—GWP in billions of tons, that is billions of tons of CO2 equivalent. This is the standard index used by the IPCC under the UN work for global climate change research, and an assemblage of those elements of greenhouse gas that impact on global warming put in terms of CO2 equivalence.

But you can see, with the current policy base which includes the Montreal Protocol, we make a significant cut in the generation of greenhouse gases to the degree of uncertainty shown, and we believe that is significant. It is the first time this has really been displayed in this fashion with any credibility. And I don't believe any Nation in the world can project this kind of data without going through the kind of analytic process that we have gone through to rack up such things as our Clean Air Act, for example, in detailed terms, accompanying with all of the other projections we have. And, obviously, as we go through the debate on Capitol Hill and have to make adjustments in strategy in a realistic way, we can continue the analysis. We can work any analysis; we see no bill on Capitol Hill now that we haven't in some fashion addressed in an analytic form, can quickly come back to your committee and discuss those excursions in some detail to see how they are doing relative to what we have selected.

The National Energy Strategy will reinforce the objectives of the Clean Air Act then by contributing to long- term reductions in acid rain and smog. And for the global environment, as shown on this, accompanied with the Clean Air Act, it will keep emissions of greenhouse gases from the United States, measured by their global warming potential, at or below 1990 levels well after the year 2000.

A key contributor to a more secure and environmentally sustainable energy future will be our commitment to science and engineering research, technology transfer, and science and math education. The National Energy Strategy contains specific measures to achieve these objectives. They include: maintaining the Federal basic science portfolio; ensuring the viability of U.S. research facilities; and expanding international collaboration on what we call Mega Projects; increasing industry's participation in R&D and commercialization of technology; and strengthening Federal support for math and science education. And in the latter case—as you know, Mr. Chairman, you've been very helpful in supporting our efforts both at the Berkeley Conference a year-and-a-half ago following the Charlottesville Conference of all Governors—we have produced for the first time in the Federal Government a compendium of everything we're doing on math and science education in all of those agencies that have a touch with technology, which incorporates about 16 different agencies.

I think it's a very powerful story that we have for the first time conducted a baseline and shown that we have about $2 billion in math and science education with a very large proportion focused on pre-college, and we have enhanced that by several hundred million dollars this year in response to the President's plea that we focus a lot on pre-college math and science so that we can have the human resources we need to conduct the research, to conduct the clean up waste problems, and to do the technical work that is so essential if we are going to have any expectation of carrying out the National Energy Strategy. So I bring this to the attention of this Committee because you have been very helpful on this Committee in inspiring us to continue our efforts on linking math and science education to our objectives in research.

Now, what will the NES accomplish over-all then in summary. The next slide is a summary of some of the principal outcomes: reducing oil imports from 65 percent to between 40- 45 percent; reduce oil use by 3.4 million barrels per day and increase domestic oil production by 3.8 million barrels a day; increase electricity produced from renewable sources by 16 percent. And, by the way, if you look in the body of the report you will see a significant enhancement beyond the year 2010 because of the breakaway from research into applied technology that we think is very realistic; increased use of alternative transportation fuels and technology by up to 3 million barrels per day; reduced U.S. emissions of greenhouse gases at or below 1990 levels; and save consumers more than $90 billion in energy costs, and that's in 1989 dollars, by the year 2010.

In addition to the items on this chart, in the year 2010 we will consume significantly less oil for each unit of GNP we produced. And in the front end of the executive summary and also in the body of the report, you will a considerable discussion on what that means. And if we talk about barrels of oil per thousand dollars of Gross National Product, that's a very vague kind of index for I think American people to grasp, but I think this Committee focusing on that will understand that we are reducing the vulnerability of this Nation to oil shocks. We have gone from a factor of 5 a few years ago down to 3 today, and I believe it is indicative of our ability to move through this system with the International Energy Agency, with the Strategic Petroleum Reserve drawdown, and so forth. There are many new avenues of approach we did not have before; but we still have to get better than that, and we can approach unity, we won't reach it probably in the 30 year period, of where Japan is today. So a Nation that completely relies on oil has less shock than we do for a variety of reasons, as explained in there, and I think that's an important section of our report.

We'll reduce total energy demand by 7.5 quads and increase supplies by 4.3 quads. I think that's important that one graph because it shows that we have to work very hard to enhance oil recovery, for example, beyond that which we have today; we do have to work very hard at it. We do believe that we can do that in a cost-effective way with new technologies; and that, again, comes out of the work in cooperation with this Committee. So, it is not as though we're putting so much emphasis on supply; it is just that we have to work harder at that. We've got a lot of maneuvering room in efficiency and conservation, we've got plenty of room there to maneuver and make great strides, as shown on that chart, and that's what we believe we have done by perhaps an alternative approach to those rather canned packages that we've talked about for so many years that we don't necessarily think are the only answer. We think there are other ways to do business more consistent with desired lifestyle of the American people.

Now, I would like to turn now to a more specific discussion of research and development initiatives that I think are of special interest to this Committee and how they relate to the National Energy Strategy.

Figure 5, that you have in front of you as well as up on the board here, is a detailed breakdown then of the research and development initiatives that have been targeted for enhancement, and this represents about 37 percent of our entire energy R&D budget submission up here on the Hill. We did not include many of the other high energy physics and that kind of initiatives; these are specifically targeted for one purpose, and I'll talk about that now. So the key to meeting our environmental, energy, and economic objectives in the future is new technology. Accordingly, the National Energy Strategy calls for increased investment in technology research and development, R&D, especially in those areas with the greatest potential to reduce the use of oil in our economy.

The National Energy Strategy will strengthen existing R&D programs in selected areas to accelerate the development of new technology. To pave the way for prompt transfer to the marketplace of the fruits of this R&D, the NES encourages joint government-industry-university cost-shared efforts and would offer prizes for those making the greatest progress in meeting technology development goals.

Let me start out with an overview of the present fiscal year 1992 budget and how it relates to the NES R&D initiatives. As shown on this slide, the present fiscal year 1992 budget includes $903 million for enhanced R&D investments in support of a government-wide National Energy Strategy initiative. This represents an increase of $227 million or 34 percent over fiscal year 1991. The budget proposes $643 million for DOE NES-related R&D, an increase of $134 million or 26 percent over fiscal year 1991. Other Federal agencies involved in the NES R&D initiative include the Department of Transportation, DARPA, NASA, the National Science Foundation, and U.S. Department of Agriculture, as well as the Corps of Engineers. So that has now been integrated in your total figure as shown there for all other Federal agencies.

Now where will this investment be directed. First, I will describe a new Government-wide R&D initiative designed to enhance energy security mainly by displacing oil used in transportation but also by increasing the efficiency of other energy technologies. Then I will outline our vision of how the entire DOE research and development portfolio will serve our future energy needs.

The NES program of enhanced R&D for energy security— and I'll just briefly touch on these—will include vehicle propulsion, electric vehicles, intelligent vehicle highway systems, high speed rail and magnetic levitation, telecommuting, aeronautical and air systems, advanced transportation fuel from biomass, advanced oil recovery techniques, industrial technologies, advanced light water nuclear reactors, advanced reactor concepts. I am not going to go into detail on those just for time. But now I would like to shift to the second point that I would like to make to go into the vision of how this entire research and development portfolio tends to serve us for the future.

This is taken from page 140-141 of our Strategy. And it is the continuum from 1990 to the year 2030 of our expectations in applying basic research through application to applied research into the commercial sector. And so you see on here a variety of R&D initiatives, most of those that were reflected in the prior slide in Figure 5, displayed in a new way; a function of time of when we might expect to see them on the scene. And this is our future vision of where the NES R&D program could lead us. This chart shows when we expect some important technologies then to enter the marketplace. For example, the outcomes we expect by the year 2000, improved geosciences to better characterize oil reservoirs, advanced underground instrumentation to find oil and new drilling techniques, and better chemical processes to extract more oil. In addition, new clean coal technology will allow a higher fuel efficiency as well as reduced SO2 and NOX emissions.

So mostly then the outcomes in the years from now to the year 1995 have pretty well been in the bank of R&D for some time. And so we're not seeing a powerful set of new initiatives that can come out of enhanced R&D in this particularly Strategy. On the other hand, let's talk about between the year 2000 and 2010. We expect our R&D programs and alternative liquid fuels from biomass will begin to pay off: new conversion processes will reduce costs and increase production; advanced renewables, wind, photovoltaics, and high efficiency biomass turbines could become an important utility choice for new capacity; new advanced light water reactors will begin to come on line revitalizing our nuclear capability; a whole series of buildings technologies and industrial process improvements will emerge; fuel cells technology in automobiles and in utilities will likely be ready for commercialization; advanced nuclear technology and clean coal technology will greatly reduce greenhouse gases and with lower costs.

So let me summarize then as far as the research and development section goes. By the year 2010, we will have unprecedented choice in clean, cost-competitive technologies to transport goods and people and to generate electricity. Between 2010 and 2030, we expect more advances, although technology predictions this far out are highly speculative. However, it is vitally important that we not lose sight of future expectations because it is today's basic research that will guarantee tomorrow's results.

And I will stop here for a minute because, if we look over here at the year 2025 and see a fusion demonstration plant, for the first time we are at parity between power in and power out in our fusion experimental work. We had some of the finest brains in the world coming together last year to tell us where we should be going now in fusion, to build some excitement into the program after 35 years of research. And we have determined that it is feasible now to establish a development program for the year 2025 to have a demonstration plant for energy. And at that very time, in appropriations work over here in the last minute of the last Congress, we lost $50 million out of the program in about a $317 million program.

That is a significant cut and it has forced us to cutback on allied research work at a variety of National Laboratories, which we think is imprudent. Nevertheless, we have tried to restructure it by asking you for reprogramming, and we thank the Chairman and this Committee for pushing that reprogramming for at least $25 million that gave us a bare bones opportunity to make fusion now a developmental effort with some real sights on a 2025 demonstration plant. So I hope that we continue that interest and don't lose heart because of a long, laborious research program that I was involved in in 1958 when I was at the Oak Ridge National Laboratory.

So I know we have a long way to go, but I do believe this is the time to make a commitment for international collaboration with the International Thermal Nuclear Engineering Reactor Experiment there, do the kinds of work that we have to do on an international base in order to fund such a large program. But it is exciting from my point of view. There are alternatives to magnetic fusion. There is some inertial confinement fusion that looks very exciting and has some potential, and so there is great competition and excitement in the plasma physics world today and I would hate to see that shattered at the very time we almost see victory; there is some light at the end of the tunnel, if you will.

Today, we have one vehicle technology and one fuel to power it. By 2010, we could have five vehicle choices and the possible elimination of the oil stranglehold on the transportation sector. Some of the best bets may result from our R&D that would include photovoltaics, superconducting materials, which many people don't see as conservation. If we can make the breakthrough, and it is possible, if we can get the fabrication techniques on some of the materials that we're now finding, that this, in itself, will have a major industrial revolution occurring throughout the world. So we have to look at these kinds of things as critical and not just contemporary gimmicks that are thrown out there as being the only thing to answer the conservation mail. We think in superconducting material we have something that is very unique. And we are now, as you know, setting up superconducting pilot centers, three of them. They are working extremely well with the private sector, and for the first time we have hope for transfer of technology into U.S. commercialization, which the Strategy pushes very hard, instead of selling our technology cheap and losing the economic leverage.

Another one of our best bets is biomass feedstocks. We have just signed a Memorandum of Understanding with the Department of Agriculture. Why the Department of Energy and Department of Agriculture threw away their relationship ten years ago, I have no idea, but they did and it was a mistake. In biomass there is tremendous potential for electrical energy generation as well as substitutes for oil in many industrial processes. And we simply dropped the ball on that a long time ago or we would have been much further along than we are today. So Agriculture does have a big role, including their research facility, and there is money in here for Agriculture to do some additional work, and we're now working much more closely with them as well as NASA and other agencies through Memoranda of Understanding as a result of the National Energy Strategy development.

We could also get results from magnetic levitation to allow high speed rail between major cities, hydrogen fueled vehicles, biological processes for industry, use of hot dry rock and magma energy and the limitless geothermal energy, and the potential for a fusion demonstration plant I have already discussed.

So in closing, Mr. Chairman, I believe the NES contains powerful ideas for America. The NES will be implemented through the shared responsibility of Government, science, industry, and the American people. This is our strength as a Nation. We have the best scientists and the best public and private laboratories. The National Energy Strategy will build on these foundations to shape

America's energy future. And I look forward to working with you on successful implementation of a new National Energy Strategy and that hopefully we can work well with the Congress over the next few months in this session.

Thank you, Mr. Chairman.

[The prepared statement of Admiral Watkins follows]

[Mr. Watkins testimony is comprised of the attached and two books entitled *National Energy Strategy* and one book entitled *By The Year 2000*. Both are available in the office of the Subcommittee on Energy located in B374 of the Rayburn House Office Building]

DEPARTMENT OF ENERGY UNITED STATES OF AMERICA

The Secretary of Energy
Washington, DC 20585

February 20, 1991

To the American People:

In July 1989, the President directed me to develop a National Energy Strategy. The mission has been accomplished. Today, we bring forth powerful ideas for America. This strategy charts a course for greater energy efficiency, improved environmental quality and a more secure energy future.

We have a strategy to meet our needs, anticipate obstacles and prepare for the energy demands of the next century. There has never before been a strategy compiled to reach these objectives through an integrated approach combining free market incentives, reduced regulation, Federal investment in research and development and public participation. All prior attempts relied on controls, taxes, subsidies and regulations.

The National Energy Strategy is a strategy of shared responsibility -- it joins industry and government and science and the people.

The National Energy Strategy is a balanced strategy -- it utilizes our natural resources while protecting and enhancing environmental quality.

And, the National Energy Strategy is a national plan of action, not merely a statement of policy. This strategy revitalizes the entire energy economy through a new approach to energy security, consumer protection and conservation.

Meeting our energy demands for the 21st Century is a daunting task. This strategy recognizes that there is no one simple answer. It requires the commitment of all of our institutions and the support of the American people. We cannot solely conserve our way, nor solely develop our way to energy security. We will only reach our important goal, we will only meet our crucial challenge, through a powerful, sensible, balanced approach to securing, developing and protecting our resources.

This strategy will help America reach the goal of energy security through improved efficiency and new technology; it will encourage growth of conventional energy sources and development of new technology; and, it will help us meet our energy needs while enhancing environmental quality. It will help us accomplish these goals without damaging our standard of living or hurting the competitiveness of American business and industry. It will not burden consumers with heavy taxes and regulation.

As Americans, we cannot expect to insulate ourselves from all the risks associated with the world oil market, but we can, and must, take action to reduce our vulnerability. This strategy will, on the one hand, increase domestic supplies of oil by 3.8 million barrels per day by 2010 and increase worldwide production capacity and strategic stocks; and, on the other hand, will make our economy less dependent on oil by 3.4 million barrels per day by 2010. This double-barreled approach will reduce our vulnerability significantly to future oil shocks.

Full implementation of this strategy will facilitate the growth of efficient markets that provide consumers with diverse, secure, clean and economical energy supplies.

Government alone is not the answer. This strategy lays the foundation for our future by protecting our standard of living; it addresses the challenge of supplying our necessary energy without imposing harsh taxes on people and restrictive regulation on government and industry. American ingenuity, technology and competition beat government regulation and taxation every time.

I strongly believe that implementation of the powerful ideas in this strategy will direct America on the right track to a cleaner and more secure energy future in the 21st Century.

Sincerely,

James D. Watkins
Admiral, U.S. Navy (Retired)

DOE NEWS

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FOR IMMEDIATE RELEASE
February 20, 1991

PRESIDENT RELEASES NATIONAL ENERGY STRATEGY

WASHINGTON, DC -- President Bush today presented the National Energy Strategy (NES) to Congress and the American people.

Calling the Strategy "powerful ideas for America", Secretary of Energy James D. Watkins said, "The NES is a strategy that, for the first time in our nation's history, lays a comprehensive foundation for a cleaner, more efficient and more secure energy future. It is a balanced approach to attaining that energy future through shared responsibility."

Implementation of the NES will decrease the U. S. economy's demand for oil by 3.4 million barrels a day while increasing domestic oil production by 3.8 million barrels a day by the year 2010. It will also result in the increased availability of electricity produced from renewable sources and could increase the use of alternative transportation fuels and technology by up to 3 million barrels per day in 2010.

The strategy also has a dramatic positive impact on the environment. It will reduce the potential threat of global warming, enhance air quality, improve water quality and address solid waste problems.

The NES is the result of more than 18 months of intense effort. It incorporates input of 448 witnesses from 46 states and reflects ideas from a vast array of energy experts and the general public.

. The Strategy was requested by the President in July of 1989--more than a year before the Iraqi invasion of Kuwait. The President directed the Department of Energy to work with federal agencies and the American people to craft a National Energy Strategy that emphasizes markets to balance our increasing need for energy at reasonable prices; our commitment to a healthier, safer environment; our determination to maintain an economy second to none; and our commitment to reduce reliance on insecure energy supplies.

To achieve these goals, the NES proposes federal, state and private sector initiatives to remove barriers to an efficient domestic energy market. The NES will increase competition and economic growth and use America's technological and scientific skills to develop environmentally superior energy technology.

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"As a nation, we have no single, simple solution to our energy problems, but this strategy puts us on the right track. It is a strategy that recognizes a true shared responsibility, joining the commitment and resources of industry, government, science and the American people," Watkins said.

"We know from experience that we can neither solely produce nor conserve our way to a secure, environmentally sound and affordable energy future. We will need to do both, and to do it in a way that doesn't penalize our economy, our people, or our environment. The NES will do just that -- it will protect the pocketbooks of U.S. consumers, the jobs of U.S. workers and the global environment. The NES demonstrates that environmental, economic and energy objectives can be brought into balance."

Watkins noted, "Eighteen months ago the President knew we could not wait for a crisis to chart a course for our energy future. That is why he directed the Department of Energy to devise a balanced blueprint to address this country's energy needs for the next forty years."

The NES represents a balanced program of greater energy efficiency, use of alternative fuels, and the environmentally responsible development of all U.S. energy resources.

The NES redefines America's energy security interests by addressing the structure and not the symptoms of today's energy markets. The NES attacks the challenge of energy security by an aggressive program to introduce alternative fuels and technology in transportation, to reduce oil demand, to expand production capacity outside the Persian Gulf and to expand strategic stock holdings.

Investing in American ingenuity and know-how is a far better way of achieving our energy objectives than relying on command and control measures, such as increased government regulations and taxes. A major element of the NES is increased investment in energy technology R&D, including more than $900 million in FY 1992 (a 34 percent increase) for investments in support of NES R&D initiatives government-wide.

Building on other Bush Administration actions, the NES measures will result in United States' greenhouse gas emissions remaining at or below 1990 levels for the foreseeable future. Taken together, the NES initiatives are expected to decrease U.S. oil consumption by 3.4 million barrels per day below projections for the year 2010 and increase domestic oil production by up to 3.8 million barrels. This balanced program would cut projected oil imports in 2010 by one-third, from 65 percent to between 40 and 45 percent of consumption.

The NES includes 17 chapters surrounding four basic themes: "Increasing Energy and Economic Efficiency; Securing Future Energy Supplies; Enhancing Environmental Quality; and Fortifying Foundations."

-more-

Members of the news media may obtain copies of the NES by calling the DOE Office of Public Affairs, (202) 586-5806.

-DOE-

COPIES OF THE NES MAY BE OBTAINED from the U.S. Government Printing Office, Superintendent of Documents, (202) 783-3238. Order numbers and prices:

Full Document -- $16.00; Stock # 061-000-00754-7

Executive Summary -- $2.25; Stock # 061-000-00755-5

The **Chairman**. Thank you very much, Mr. Secretary.

You do have a visionary proposal here and despite a few minor objections from members who think that it doesn't either do enough for production or enough for conservation, I think you're on the right track. The tragedy is we should have had this track laid out and made a commitment to it 15 years ago. All of these technologies this committee wrestled with back in the mid-1970s and we thought we were making progress but we were unable to cope with the influence of the decreasing price of oil. And, unfortunately, we're now back in a period which is critical. The difference is today that there are two reasons for that being critical: one is the undependability of the oil supply, and the other is the increasing awareness of the global environmental impact of reliance on fossil fuels. So, hopefully, we will be able to move forward at this time in a way that's different from what we did 15 years ago.

Our distinguished ranking minority member has graced us with his presence and I would like to recognize him for any comments he would like to make at this point.

Mr. **Walker**. Thank you, Mr. Chairman. I understand that my statement was included in the record and I will allow it to stand that way and go on to questions.

The **Chairman**. The Chair is going to enforce the five minute rule as much as possible and, as I said, recognize members in accordance with the order of their appearance.

We will start with Mrs. Lloyd.

Mrs. **Lloyd**. Thank you very much, Mr. Chairman.

Mr. Secretary, I think that what we're really looking for today is a better breakdown, to make this a little bit more believable. So what do we expect each technology to contribute to our energy mix a little bit closer than 30 years. Where do we plan to be in 10 or 20 years? What percentage of coal or other fossil fuels, solar or other renewables, or hydro or nuclear do we expect to play in our energy mix?

As you know, with our Federal budget we break it down to a pie, our expenditures are broken down to the pie shape to really explain where we're going. What do you anticipate is the role nuclear will play, solar will play, conservation will play as we look ahead? I think we really want to see something closer at hand than 30 years.

Admiral **Watkins**. We have I believe in the Energy Strategy document—I am trying to find it right now—in each of the cases a representation of where we are going in the electricity sector by component, that is by renewable energy, by nuclear, coal, gas, and backing out of oil. And I think to the extent that, for example on page 33 in figure 10 of the Strategy, it breaks all those out and shows you how this integrates with things, for example, like nuclear. You see in the nuclear base, for example, extended life of the current plant just been authorized by the Nuclear Regulatory Commission. It also shows growth by the year 2015, a significant growth, in the advanced light water passively safe systems, the new one which we believe will have industrial interest and the investment desire on the part of industry, utilities to do it.

You will see coal maintaining a very, very powerful center role in generating electricity. And this is why clean coal technology becomes so critical, because we really do not have a choice as a Nation if we want to have the growth, and it is rather modest growth that we outlined in our Strategy, plus we can expect new results with each new generation.

Mrs. **Lloyd**. Mr. Secretary, this is mix of fuels to generate electricity. I am talking about the energy mix for our Nation; what we expect conservation to do, what we expect solar to contribute. I think that's what we're really looking for. And I hope that we can work together this year to really let this be a reality. I think this is what our Nation is really hungry to see.

Now, one other thing I would like to ask you. You looked at the contribution of nuclear to be 21 percent, I believe, in 2030. Mr. Secretary, this is about the percentage of the energy mix today. Do you not envision an increase in the overall percentage of nuclear?

Admiral **Watkins**. No, but that means a doubling of the number of plants, Mrs. Lloyd. That's going from 110 plants to over 200 plants. So it is not trivial. If we're going to have growth in the Nation at rates that are even close to 1.8 percent real growth in Gross National Product up to 2.4, you can see how we have outlined that by the Council on Economic Advisors giving us those projections, which are fairly reasonable projections for the future, that we are simply going to have to have growth and that means that we are going to double the number of plants. And that is no mean task. That's all in the Strategy, all that stuff—

Mrs. **Lloyd**. But even with the growth, it would still be around 21 percent, is that correct?

Admiral **Watkins**. About 21 percent is what we are estimating; and that is with all the new advanced light water systems and so forth. So that is one. We do have the data on each one of the elements—what is possible in photovoltaics, what is possible in hydropower. Hydropower potential is basically there except for regulatory barriers where we believe 20,000 additional megawatts can come out of existing repowered turbines on existing dams. And that is what we are after in the Strategy. So all of those are outlined in here in detail and give you exactly the number of barrels of oil equivalences that they back out. So I think we do have the data and we will certainly work with you and we can rack it up anyway you want to because the analysis is there.

Mrs. **Lloyd**. Thank you.

I had a question for Mr. Moore. Mr. Moore, how important do you see that licensing reform is going to play in an energy strategy?

Mr. **Moore**. We can certainly try to equate that for you or calculate that for you or quantify that for you based on the analysis. I think the Admiral answered your question when he said it is the analysis behind the document you have in front of you that gets into the justification for these conclusions. That analysis has not been published, but that analysis we'll make available to members of the committee and committee staff when they want to know more about a certain thing.

Certainly in the area of licensing reform, this is one of the major things we have to do—

Mrs. **Lloyd**. Well, how hopeful are you—

Mr. Moore. Or you do not get anywhere with bringing back nuclear power. We certainly realize that and it is one of the things that requires legislation.

Mrs. Lloyd. How hopeful are you that licensing reform will be a reality?

Mr. Moore. I think that now we have come forward and will be coming forward this week with a comprehensive piece of legislation for both house of Congresses. We have all of these energy issues that require legislation in one bill; then maybe the Congress can see the wisdom, and the Administration working with it, to come forward with a solution. You realize if you take these things up one at a time, we seem not to be able to deal with them because somebody says, well, you have not done enough for conservation. And they can not see it in the same piece of legislation where you are working on licensing reform. Perhaps by putting them all in one comprehensive bill, we can reassure everyone in the Congress we have strong opinions about all of these things, that all are being considered and taken care of, and, therefore, we can move forward.

And so I am hopeful that we will be able to now with the country and the Congress, by virtue of events in the Middle East, focusing on energy, we will be able to do something this year.

Mrs. Lloyd. Okay. My time is up. Thank you, Mr. Chairman.

The Chairman. Thank you very much, Mrs. Lloyd.

Mr. Boehlert.

Mr. Boehlert. Mr. Secretary, in your oral presentation you said that oil has a "stranglehold on the transportation sector," those are your words and I agree with them. How is it then, in view of that, that we can have proposed to us a National Energy Strategy that does not have any specific recommendations on increased fuel efficiency standards for cars and trucks?

Admiral Watkins. Well, in the first place, Mr. Congressman, we have addressed the increased auto fuel efficiencies. It may not be in the classic form that is now represented by the so-called Bryan bill over in the Senate that we all worked on last year, but it does have an address of this in a way that says let's try to cut back the rhetoric and let's get together on the analysis, including the safety envelop for human safety, and let's get serious about how we are going to set these numbers so that when we set them they are technically feasible. They are not going to put 14,000 people in the industry out of business, and that we can really do this job in a sensitive way to human safety. I think when we do those things—and we can do them this year; I am not talking about a long study. The Secretary of Transportation and I have agreed on an aggressive approach, we have gotten the National Academy to agree that they are going to come to grips with the analysis of this thing in a way that says that is the right number and that is the way to go.

Mr. Boehlert. What's the CAFE standard right now, Mr. Secretary?

Admiral Watkins. The CAFE standard is 27.5 miles per gallon.

Mr. Boehlert. I recall, and I have a long history up here, I used to be a staff member; I started as a starry-eyed kid in 1964—but in the 1970s we had a big tycoon came in from Detroit and he told the Congress that it was absolutely foolhardy to think in terms of a CAFE standard of 14 miles per gallon. He said it would ruin the industry, it would not be safe, and he gave all sorts of dire predictions. That fellow was then a senior vice president of Ford; his name was Lee Iacocca. I would say he was wrong and we were right to proceed as we have. But, quite frankly, I must register my great disappointment at sort of looking the other way on increasing the CAFE standards in view of the fact, and I agree with you 100 percent, that oil has a stranglehold on the transportation sector. So that's something we're going to have to talk about and work on.

Let me go to another area. The President's charge was for the Department of Energy to devise a balanced blueprint to address the country's energy needs for the next 40 years. I am having a hard time finding any balance in a proposal that has an almost 2-to-1 advantage for fossil fuels and nuclear power over conservation and renewables. Can you address that for me, please?

Admiral WATKINS. Well, I don't think the data reflects that. I tried to show that in figure 3 in the briefing the net result of—

Mr. BOEHLERT. Well, the figures I have for 1992, correct me if I'm wrong, renewables and conservation get $526 million requested, and fossil and nuclear fusion get $962. That looks like 2-to-1 to me.

Admiral WATKINS. Well, I'm not sure—you're talking about budget and I'm talking about the Strategy. I think that while they are definitely coupled, I don't think if you just take dollars alone are going to be the answer to the ills of mankind. So I think we have to look at—we're talking about the Strategy today, Mr. Boehlert and I think that we have addressed that very thoroughly.

We've also said that we're going to save 3 million barrels a day by our approach to alternative fuels to get us out of oil; CAFE doesn't get us out of oil, as you know, from automobiles. It still keeps oil. You may be able to get more miles per gallon, but also all the data shows that when we give you a car with 27.5 or 33 you drive more. And so if we are going to decide that everything is going to stay constant and people are not going to drive any more when the car mileage goes up, I think we are mistaken from the real data. Also, the Energy Strategy itself, with Clean Air Act, drag the miles per gallon up to something around 31 miles per gallon all by themselves if we don't do anything else.

What I am saying is there is a lot of incentive and pressures in the basic system of Clean Air and this Strategy to get us out of oil and to give us alternative mixes that are competitive in the price sense. So then we can make some real decisions; rather than trying to pick a time, like the year 2000 for 40 miles per gallon, which we think is extreme. We fought it last year successfully on that basis and it hasn't changed from last year. So I think that rather than go back to something like that, we need to do the analysis and to say, all right, we can agree to disagree on the way we approach the thing analytically, but we come out about like this, and then we can make some commitment.

Mr. BOEHLERT. Well, I look at the same data and draw a somewhat different conclusion. Perhaps you can justify your assertion that a 40 mile per gallon standard by the year 2000 would be extreme, I don't share that view; but that doesn't argue for maintaining 27.5 mile per gallon for the next decade.

Admiral WATKINS. I agree, to that but I don't think we are proposing that either in here, Mr. Boehlert. We're trying to say, if you'll read our CAFE option that is in here, we are saying let's get on with the detailed analysis this year and let's try to work with Congress and find an answer that surrounds all the variety of issues that have been so contentious on doing the analysis. And remember this, there are numbers like 2.8 million barrels a day are saved by going to 40 miles per gallon. I would like to show you how that analysis is significantly flawed, and we believe ours, worked out with EPA, is solid, it has been worked through the mill ad nauseam over the last seven months, and we think it is good analysis. And we're showing that alone will get 500,000 barrels a day, will not get 2.8 million; we will get 3 million and that's significantly more than 500,000. So I would like to get that argument going with the technical people on your staffs and really try to understand our modeling and their modeling.

Mr. BOEHLERT. Mr. Secretary, I welcome that input.

The CHAIRMAN. Mr. Scheuer.

Mr. SCHEUER. Thank you, Mr. Chairman.

Mr. Secretary, the great thing that comes out of this hearing and comes out of my understanding with you, a knowledge of you as a person is that we can work with you and we want to work with you and we will work with you cooperatively, informally, without rancor and hostility over this next year; that's the great plus. And so I don't want to be a dog in the manger and project the death of a thousand slices. I do want to make a remark about proportionality.

You've done a lot of good things; in fact, there is virtually nothing in your Energy Strategy that one could complain about. One could complain about the relationships and the priorities. For example, on improved vehicle propulsion technology, there is a $3 million increase, not very much; fuels from biomass, $3 million; targeted building energy efficiency, an enormous target of opportunity, $10 million. The Federal Government is the biggest landlord in the country and it is a really stupid, wasteful manager. We ought to bring pressure on the Federal Government to bring them into the 21st century. Photovoltaics, $4 million. Now, you have $23 million for fusion. Now, I think fusion down the line 20 to 40 years holds a lot of promise, but it is at least 20 to 40 years, and I would say that in the short run all of these things that I mentioned that are getting comparatively piddling increases have an enormous potential. So I don't criticize encouraging fusion; I would have reservations about doing so little, really inconsequentially, on these short-run and middle-run technologies that could have an enormous impact on our energy and efficiency and energy conservation, particularly alternative fuels, over the next decade, by the year 2000.

Let me also express a reservation on your view that 40 miles per gallon was excessive. I echo what my colleague from New York had to say on the Republican side. The automobile industry has been disingenuous and faint hearted over their own talent, over their own genius. We know damn well they could perform if they set their minds to it. And my colleague from New York, Jerry Boehlert, is absolutely right; they have told us time and time and time again we couldn't do it, we can't do it, that's making too much in demands on us. Then when we pass the legislation, they do it and they do it very professionally and very effectively.

Honda just announced last Saturday that they're coming out with a 65 mile per gallon car and will be marketing it. And the Germans, the Dutch, the French, and the Japanese all have prototype models now, working models that we've seen here in Washington, that go 80 miles per gallon in the city and 100 miles per gallon in the country. And the Japanese have one down the pike that's going to go 120 miles in the country. So to say that our industry couldn't cut the mustard with 40 miles per gallon by the year 2000, Mr. Secretary, I think you don't have enough confidence in their ability and they don't have enough confidence in their ability, or else there is some unspoken consensus that we're not going to make any demands on them whatsoever to match the billions and billions of dollars of research and development expenditures that our competitors have made all over the developed world, and that we're just not going to make any demands on them at all. I think they damn well could do it if they put their minds to it, and I think it is a shame that the Administration--and now I'm talking about the White House—doesn't give them a challenge and say, hey, look, we know you can do it; let's do it.

Admiral **Watkins**. Well, Mr. Scheuer, one of the things that we've found in the analysis is that you can go to a showroom today and buy, for example, a Honda two-seater CRX and you can exceed 50 miles per gallon. The question is who buys them; and not very many people buy them. So we've tried to take into account what is going to be attractive to the American people without forcing something down their throats in either driving mileage restrictions or the kind of car they can put on a freeway with supertankers running over them at 75 miles an hour. And so I think that the studies run by the Department of Transportation are very responsible studies and they show a significant increase in fatalities on the highways by going to the smaller vehicle too fast.

We are not against the high efficiency, we are just trying to get the timing down to make it reasonable and not have this contentious argument all the time, that we believe that we can solve by asking an external agency, such as the National Academy of Sciences, to come in with a properly qualified team to present to the Congress and us their analysis and do it by June. That's what is in our proposal and I hope that would be in time to put some balance into the debate as we go through this year and not allow this to be the only issue that we deal with. We've got 100 different ideas here converted to action, and that, in our opinion, is trivial if you look at the large Strategy here and what we're trying to accomplish. And we think we're doing it by other means very nicely.

Mr. **Scheuer**. Mr. Secretary, we all look forward to working with you. Thank you very much.

Admiral **Watkins**. Thank you, Mr. Scheuer.

The **Chairman**. Thank you, Mr. Scheuer.

Mr. Simpson? Mr. Simpson is not here.

I'll take the next Republican. Mr. Zimmer.

Mr. **Zimmer**. Thank you, Mr. Chairman.

I would like to touch on something that's mentioned in your Strategy documents but without as much specificity as I would be interested in, and that's the role of the Federal Government as a model consumer. I think it is awfully important that the Federal Government buy energy efficient products and practice energy efficiency not only to lead by example, but to create markets for products that can be used by the private sector.

You mention that you're going to expand the Federal fleet of alternate fuel cars. Could you quantify that; tell me how many cars you anticipate owned by the Federal Government that will run on alternate fuels?

Admiral **WATKINS**. I don't have the number at my fingertips, Mr. Zimmer, but I do want to refer you—I am having Ms. Stuntz open up to that section that deals with the Executive Order. The President has agreed to initiate an Executive Order—we expect it out very shortly—that will address the entire Federal fleet; that's not just DOE, that's all Federal fleet. It goes like this, the Administration will issue and implement an Executive Order directing Federal agencies to continue and strengthen their efforts to improve the efficiency and management of energy use in Federal buildings and other facilities. This will our include converting our Federal fleet to alternate fuel vehicles, such as compressed natural gas vehicles and others. That's expensive but we believe that an aggressive program set out by Executive Order is the way to go to set the tone.

It also is very important when you get into things like lighting of our Federal buildings. As we know, lighting in the country absorbs about 40 percent of our electrical generating capacity. So these are very critical issues and we're taking them seriously in here. And the fact that this is the first time a President has set standards for his own Federal facilities, to set the example, I think is important. It should be out within a couple of weeks.

Mr. **ZIMMER**. Okay. It was that language that lead me to ask these questions, because it is encouraging but it is non-specific. Are you in a position to give us any specificity, for instance, on the extent to which Federal buildings would be retrofitted to have more efficient lighting and be better insulated?

Admiral **WATKINS**. I think that it would be probably best if I supplied you with the details of our analysis from our Conservation Renewables Directorate in the Department of Energy, Mr. Zimmer, to answer your question. I just do not have the details, and I do not believe we have them at our fingertips here this morning.

Mr. Moore has something.

Mr. **MOORE**. I'd simply add that this is currently still working its way through the interagency process of the Administration and will be finished, as the Admiral said, probably in about two weeks. So we can't give you the specificity; it is still being decided upon in terms of percentages of reduction in electric consumption, in terms of size of fleets, and all the rest. It is still being worked on.

Mr. **ZIMMER**. Do you contemplate increasing the energy efficiency of the conventional fueled vehicles in the Federal fleet?

Mr. **MOORE**. Yes.

Mr. **ZIMMER**. And that will be part of the Executive Order?

Mr. **MOORE**. Yes.

Mr. **ZIMMER**. Well, I look forward to seeing that and I really hope you'll be aggressive because I think it is entirely consistent with the Administration's philosophy and it could accomplish a great deal in side benefits.

To switch for a moment. What are the Department of Energy's plans for hydrogen research and development as part of its Energy Strategy? Hydrogen as a fuel for automobiles and—

Admiral WATKINS. Yes, we mention that in my summary.

Mr. ZIMMER. Well, specifically, what do you see as -

Admiral WATKINS. About 2010 I believe is when we see that coming on. I am trying to find the specific—We do have an existing research program that we're working on in hydrogen fuel that's going on now.

Mr. ZIMMER. What do you think is the long-range potential of hydrogen as a fuel to meet energy needs? Do you contemplate that this could be used—

Admiral WATKINS. I think it has tremendous potential, Mr. Zimmer. I am trying to find it right now as to where it is in the scheme of things.

Mr. ZIMMER. Right. I understand it is on the chart, I am just wondering do you contemplate at this point that it could be used, given what we can see now in the very relative early phases of its research, could it be used as an alternate —

Admiral WATKINS. Yes, sir, in the fuel context cell it can be. So I think it—

Mr. ZIMMER. For automobiles?

Admiral WATKINS. It is incorporated into the fuel cell discussion. I don't have it broken out here for this discussion. I could have it for the budget deliberation on exactly what we're putting in to the hydrogen research itself in our base program.

Mr. ZIMMER. At this point, what technical hurdles do you see for the hydrogen program?

Admiral WATKINS. The cost of making hydrogen and storage is the wisdom here that's been passed to me.

Mr. ZIMMER. Okay. Thank you very much.

The CHAIRMAN. Thank you, Mr. Zimmer. I want you to join this small, hardy band of hydrogen enthusiasts that we have on the Committee and we'll try to get them to speed it up a little bit.

Mr. ZIMMER. Good.

The CHAIRMAN. Mr. Glickman.

Mr. GLICKMAN. Thank you, Mr. Chairman.

First of all, I want to compliment you, Admiral Watkins, and the Department for your outstanding but unsung work that you've done in Desert Storm. A lot of folks don't know about what the Department has done in coordination with the Department of Defense to stop the oil spills, to warn our soldiers about the effects of oil fires, to deal with putting them out, and a whole lot of things that are very important to the success of that operation; and I just think it is important that your personal experience, what it's had to make sure that this campaign is as successful as it is.

Admiral WATKINS. Thank you very much, Mr. Glickman.

Mr. GLICKMAN. Now, the bad part. Okay.

[Laughter.]

I must tell you that I do think that this energy program has some good things in it. But I think what's important is not what's in it, but what isn't in it. While some of the stuff that's in it—like, for example, drilling in some of the offshore areas—I have some problems with; you've got some good things in there. But it looks to me like it's a tepid response to a pretty cataclysmic problem in this country. We're in the Middle East in part because of energy and people never want to have to fight and die again for that. Even though there are other reasons, that's a large reason why we're there.

It looks to me like fundamental to getting ourself independent are two things.

First, pricing energy so it encourages domestic production and encourages alternatives. All these great programs there, many of which we all support, have very little chance of being implemented if the natural pricing structure of energy doesn't encourage people to meet alternatives, to put alternatives into the marketplace. And what strikes me is by not putting in some form of oil import fee or some form of stability on pricing, you are having one foot on the brake and one foot on the accelerator because you're not basically providing the market mechanism, the stability for people to go out and do all the things that you want them to do. Whether it is producing domestic energy in Kansas, or Texas, or Oklahoma, producing ethanol, producing all the other technologies; it is not there without that stability.

And the second point I would make with you has to do with the CAFE standards and cars. And I want to echo what Mr. Scheuer and Mr. Boehlert said. Two-thirds of the oil we use is for transportation—two-thirds is for transportation. Much of that, if not most, is for cars and light trucks. The number one issue, it looks to me, is how do we get a reduction of energy into that vehicular transportation in this country. That's the prime way we are going to be able to get utilization, conservation up, and maybe just release that need to have to go to war for shortages of petroleum. I happen to believe in higher CAFE standards; I have a bill to do it as well. I realize that you think it can be accomplished somewhere else. I guess what concerns me about this part of the problem is that there doesn't seem to be a commitment on the Department of Energy's side to believe this is an important part of the equation. It looks as if you have bought Detroit's argument that it just can't be done. And, for my judgement, the research indicates that it can be done; that we could go up to about 40 miles a gallon without having any fundamental technological change in the way that we produce cars. We can argue about the timetables and everything else.

And so I guess I would ask you to respond both in terms of the pricing of energy, which it surprises me because I thought the President was on record in favor of an oil import fee at one time. I don't see it in there. And I'm not interested in it for abstract reasons; I'm interested in it because I don't think we can produce energy in this country practically, whether it's oil, gas, coal, or the alternatives — biomass or anything else, without having a stable pricing thing. And then going back to this car thing, this CAFE thing. I just think it is a mistake not to push on it.

Admiral **Watkins**. Well, we have certainly, Mr. Glickman, looked at all of the points you have raised in our analysis. We want to share that data with you. It is our belief that the heavy emphasis on CAFE as the answer to the Middle East situation is too simplistic. We don't believe the savings are 2.8 million barrels a day by the year 2000; we think they are like 500,000 barrels a day, and we can show you the analysis of why that's the case.

We've also looked at pricing energy. In fact, there were six options that we considered because we listened around the Nation to people making the same kind of comments you just made. We looked at oil import fee, we looked at raising 25 to 50 cents to a dollar per gallon on gasoline to force situations like that, and that's a pricing alternative.

Mr. GLICKMAN. Did you look at an oil import fee at $20 a barrel, $22 a barrel?

Admiral WATKINS. Yes, we did. We looked at a variety of things up to $25 a barrel—from say $21 to $25 a barrel, variable import fees, many of the things that have been recommended by the oil industry, for example. We had a letter from the former Governor of Texas that was very strong, in fact, many, many letters on variable import fee. And the President sent over several to me to say, please, look at it again. So we went through that analysis, presented it to the Economic Policy Council, including the President, to make the point—in fact, in my private meeting with him I said, this keeps coming up and I want you to know what our analysis shows. We are going to do this by other means rather than try to bring the wrath of Jehovah down that all of a sudden we're more interested again—we've already been accused of being overly interested in oil and gas in our Strategy, and this would just be another indication. After the last reconciliation bill that gave us incentives for independents in that area, it would be another indication and why do it if we do not have to do it.

So our belief is that we do have the Strategy set up in a way that provides the incentives without the egregious violations of certain things that I do not think we would like. For example, we believe that a $25 barrel floor would be about $150 billion impact on the Gross National Product. So we have worked out a lot of this analysis that says it sounds pretty good, that the investment is going to take place, and that we are going to do all of these things. We rather think that there are other sources of revenue such as opening the Arctic National Wildlife Refuge, such as going into the nonrestricted Outer Continental Shelf areas that are not restricted by the President, and do those kinds of things with the revenues being somehow focused back into the funding of the Energy Strategy itself so we can look at alternative fuels to oil rather than just trying to say, we want less oil in the car but we are not interested in the alternatives.

Mr. GLICKMAN. If I just may add and then my time is up. One is those things primarily help large multinational oil companies and for the production of oil domestically those items aren't particularly relevant. But I would then go back to the point, and just ask you to consider it, you have got to price energy according to what its replacement value is and that replacement value has to contemplate lost lives in the Persian Gulf. And if you do that, then maybe you might get some of these alternatives actually implemented into the marketplace because there will be a stable price of energy over a long term. I guess that's my point.

Admiral WATKINS. Yes, sir, I understand.

The CHAIRMAN. Thank you, Mr. Glickman.

The next person on my list is Mr. Lewis.

Mr. Lewis.

Mr. LEWIS. Thank you, Mr. Chairman.

And thank you, Mr. Secretary, for your energy policy, which I think is a step in the right direction though I am sure we all have concerns with certain parts of it and it probably doesn't go far enough. I have great concerns as to why with the obvious environmental concerns that we should be looking to offset do we continue to want to drill for oil off the coast of Florida. And in the best interests of the country economically, couldn't we spend this money for alternative fuels. That's the first part of my question. Given the strong objections of the members of the Florida delegation who oppose offshore drilling such as I do, why do we continue to look at this no win situation? And from the geologists soundings, currently they're looking at about a 60 to 90 day oil supply, so why are we even considering this area as part of the overall search for oil and exploration for oil?

Admiral WATKINS. I would like to ask Henson Moore, my deputy who has been kind of my right arm to monitor that with interior, to talk a little bit about Outer Continental Shelf and why oil drilling.

Mr. MOORE. Certainly, we understand your sensitivity about Florida, but nothing in this National Energy Strategy revisits the areas the President took off until the year 2000 or beyond from drilling. We're talking about the areas that he has determined are not environmentally so sensitive that we can't drill. And so none of those areas in Florida that he took off were under consideration in this National Energy Strategy.

The second point you made about why don't we spend that money elsewhere. OCS drilling is a revenue raiser for the Treasury not an outflow of money. The Federal Government gets money in in terms of leasing, in terms of royalties and payments to the Treasury. It doesn't cost the Treasury anything; quite the contrary, if you do not drill you lose money. That is not the reason why it is being done.

The third reason why it is being suggested is the fact that we are expecting, of the 3.8 million barrels a day of increased production, the chart the Admiral spoke to earlier, better than 100,000 barrels of that a day, and that is very conservative, comes from new OCS areas of production. And so if we do not drill in those area, we're not only losing the money, then you've got to make up that 100,000 barrels a day someplace else with increased tanker traffic coming in, increased imports, or some other kind of a program that you concoct to try to get away from it.

Mr. LEWIS. I see. I guess I just feel that glancing through the energy policy that I just see between the lines that there is going to be a lot of exploration for drilling in order to make up this 3.8 million barrels a day and I just have a concern as to why we're not looking at other ways—if we're going to conserve 3.4 million barrels a day and then increase pumping out of the ground 3.8 million barrels a day, we haven't really saved anything, we've lost 400,000 barrels a day.

Mr. MOORE. No, I don't think the math adds up that way. We call for an increase in alternative fuels of 3 million barrels a day over what we're doing now; and of the drilling, the increased production figure you used of 3.8 million, which is on the chart, better than 3.2 million of that comes from enhanced oil recovery from existing fields and existing wells by improving the technology base by only 15 percent. If we can increase our rate of recovery from the current rate of 33 percent to 38 percent, that's where you get 3.2 million barrels of that 3.8 million barrels you saw on that chart.

Mr. LEWIS. Okay. One final area that I'm also concerned about, Mr. Secretary, is the air transportation efficiency. I notice the energy efficient aeronautic and the efficient air traffic control are two of the lowest on dollar change on your budget for this program. How do you plan on working with the FAA to improve their air traffic control system, which certainly needs a lot of work when you have anywhere from 10 to 20 planes lined up burning several hundred pounds an hour of fuel all over this country at major airports, we're talking at least a million barrels a day just in that.

Admiral WATKINS. I'm going to ask Linda Stuntz to answer details. But one of the things that I think we've all benefitted by in the Executive Branch is the pulling together of the various agencies that work these problems. We've worked very closely with the Department of Transportation and the FAA on this initiative and this is very strongly influenced by that cooperation.

So I would like Ms. Stuntz to talk a little bit in more detail about the specifics.

Ms. STUNTZ. This will be under the leadership of the FAA and the Department of Transportation, and—

Mr. LEWIS. We're in trouble.

Ms. STUNTZ. Sorry, sir?

Mr. LEWIS. That's all right. I'm sorry.

Ms. STUNTZ. But working with them to understand energy consequences of what they may be doing to better coordinate air traffic control so you've got less time sitting on the runway, less time in the air, I think the problems that you're well aware of. In 1989 U.S. air carriers logged about 446 billion passenger revenue miles, almost a million barrels a day of jet fuel and aviation gasoline; general aviation adds an additional 700,000 barrels a day to that. If we can just make incremental improvements in the efficiency with which the system operates, that's a target of opportunity that we want to take advantage of.

Mr. LEWIS. Okay. Thank you, Mr. Chairman. Thank you, Mr. Secretary.

The CHAIRMAN. Thank you, Mr. Lewis, for your fine questions. Mr. Kopetski.

Mr. KOPETSKI. Thank you, Mr. Chairman. And I would ask unanimous consent that my statement be made part of the record as other members may have—

The CHAIRMAN. Do you have your button switched on, Mr. Kopetski?

Mr. KOPETSKI. I don't know if they gave me a button, Mr. Chairman.

Thank you. Mr. Chair, I ask unanimous consent that my statement be part of the record, and there may be other members who ask that as well.

The CHAIRMAN. Without objection, your statement will be in the record, and any others who have similar requests.

Mr. KOPETSKI. Thank you, Mr. Chair.

Admiral, your reputation and your great work in the energy field reach all the way out to the northwest and to Oregon and I commend you for that. I'm new here, I'm new, and so I am trying to learn a lot here. And I try to go along with what my President says, so he tells me to check the air in my tires, I check the air in my tires. So, you know, we did that, now we get down to an energy policy for this country, finally, and I am just really struck by this whole notion of doubling the nuclear power plants in this Nation. What period of time was that going to occur?

Admiral WATKINS. It would be about a 20 year period.

Mr. KOPETSKI. Well, it has been my experience—and we have a nuclear power plant in the northwest and probably the only thing more difficult than sighting a garbage dump is sighting a nuclear power plant. I don't think the Administration—I think they forgot about WPPS in the Northwest and what happened with that fiasco, I mean energy and financial fiasco in the northwest. And we're talking about doubling the number of these power plants in this Nation when we haven't solved the nuclear spent fuel problem yet. We had a ballot measure in my State just here in November, a few months ago, where a good contingency of Oregonians said shut it down until you've solved this problem. Now, I didn't go along with that because I said now the nuclear power industry and the Government I'm sure they're going to come up with a solution.

But it seems to me folly, great energy and economic folly to put in as a fundamental aspect of an energy policy for this Nation a kind of producing facility where we don't have the solution to a tremendous environmental and economic problem. We've got a whole host of energy plants, as you well know, Admiral, such as Trojan in my back yard, which is going to discontinue because there is a limited life to these plants. And we haven't solved that problem. Could you respond? I mean, are we going to solve this problem this year?

Admiral WATKINS. No, no. I don't think so.

[Laughter.]

Let me talk about it because it is a very good question and it gets around this entire nuclear issue. I can tell you this, if we do not solve the spent fuel issue on the existing 110 plants we have—not even counting expansion—by not finding a proper repository and going through the monitored retrievable storage set of issues, then there won't be any future for nuclear power. We're not saying that the environment out in the year 2010 to 2030 is going to be as shown here. We do not have any expectation that you can do this casually. This is going to take a tremendous amount of work this decade to solve the waste problem on the existing plants. If we do not solve it, there won't be any future for nuclear power. It is as simple as that. Now, that does not mean that we are going to give up.

I am in the middle of a court battle; it is in the Supreme Court, the Congress of the United States said we are going to do the research work to determine the feasibility of a repository at Yucca Mountain. I did not decide that; that was decided by the Congress of the United States. So I am trying to do everything I can to carry out that mandate. I am being thwarted by the State of Nevada, and as a Nevadian might think, you know, I could see how he would object. Look at the "not in my backyard" syndrome all over the country. All States are closing their boundaries to further waste incursion, whether it's toxic waste, municipal waste dumping, or whatever it is. So this is a major issue and it is in the Energy Strategy.

We talk about waste minimization, waste generation, and so forth as a key element that the builders of energy sources in this country have got to be sensitive to the waste generation problem downstream, and they have to cost it out. Now, so we're on board with you on this thing. We're not going to run off willy-nilly. This is the first of a dynamic series of strategies that will come up here biannually to the Congress. If the R&D does not prove out that we can build an advanced light water passively safe system; if we do not minimize the waste generation, possibly with actinides burn up so that we do not have these egregious actinides that we have to bury in these costly repositories; if we don't solve some of those things, then we will know over the next five to seven years; and so, therefore, that curve that we saw up there, that expanding nuclear power, could go down.

In fact, if we did not do anything to expand existing lives of nuclear power plants, such as the one you have in your own State of Oregon there that was in contest politically, if we didn't do that, we would clearly go out of business. In fact, we've run an excursion here that says if we do not solve the spent fuel element issue on the existing plants, clearly there is no future for this until we get all the way up to fusion, which has a minimum of waste generation except in the radiation of the materials in the particular fusion energy reactor.

So we have a lot to do on this and we have a lot of time to work the problem. But our goal is that if we extract nuclear, then you have to accept, if you want real growth in the Nation, the other alternatives, which probably will be more coal and more gas fired base plants at the very time you'll probably be very concerned by the year 2010 of will we be a net importer of natural gas in this country, taking a look at too much demand against natural gas for base power plant generation, for compressed natural gas vehicles, and the like. So all of this has to be put in the context that we're on round one of the ladder of a forty year ladder here. We have a lot of time to work it but we should not throw out nuclear power on the basis of today's political obstacles. I think we have to overcome that by education and by demonstration that we are prudent managers of the public trust in this one highly technical and complicated area.

Mr. **Kopetski**. Mr. Chairman, I appreciate the fact my five minutes is up, but, Admiral, you know, there's another word and there's another producing facility in reality and it is called conservation. That is another alternative and you failed to even mention that as an alternative of what we might do if nuclear power isn't a mainstay of the National Energy Policy or if we get two years down the road or three years down the road and we still haven't solved the spent fuel problem for existing plants. I think this Administration better wake up to the fact that we've got to invest in conservation in this country.

The CHAIRMAN. Admiral, I'll let you respond to that in writing later.

[Laughter.]

Admiral WATKINS. One-third of all our action items, Mr. Chairman, is in the area of conservation—one-third.

The CHAIRMAN. The Chair wishes to indicate to the members regretfully that we have a commitment from Mr. Watkins for only a couple of hours of his time. In order to get him back some other time, if we keep him too long, it will be more difficult, I am sure. What this means is that every member is not going to be able to have five minutes because we're going to come to a close about 12:30. Now, let me say this, I am very, very pleased with the attendance here. I want to assure every member that we can learn while we're listening as well as while we're talking. And I hope that you'll appreciate that.

We are scheduling another day of these hearings on Thursday. I invite members who are interested to attend that and I will recognize first those members who don't get recognized today. We will try to be fair but there are limits on how much you can do with the time that we have at our disposal.

Now, having gotten that off my chest, I now turn to Mr. Gilchrest.

Mr. GILCHREST. Admiral Watkins, it is a pleasure to have you here and I hope that we can all work together on this Energy Strategy. One of the reasons I think it is so vitally important, you make several references to the year 2030 and the year 2040 and I imagine there's a lot of people in this room that recognize that 1940 or 1950 was not a very long time ago and the decisions that were rendered in those years, we are receiving the direct results it has impacted on our lives. So, what we need to do here is work on a strong teamwork effort because 2030 and 2040 is right down the road; it's not very far off.

I have a lot of things to say and a lot of things to ask, but I'll focus in on one particular question because of the time limit. I'm very interested in the idea of fusion and the commercial use of fusion. What I want to ask is, What are the potentials for the commercial use of fusion in this country and what preparations in the infrastructure of our industrial base needs to be looked at in order for fusion to be accommodated into our economy in its maximum potential?

Admiral WATKINS. I think we're at the point now, Mr. Gilchrest, that if fusion is going to survive as an option, then we have to agree—and this Committee is the only place that can do that, has the strength of conviction to say let us make it a development program or there is not any fusion concept, it is just a research gimmick, it is a nice thing to do but it is not going to go anywhere.

When you go from research to development you then make a commitment not only to ourselves but to the world and our friends around the world with whom we're allied on this subject that this is the long-term hope for mankind that we have a limitless source of energy. And I believe, like going to the Moon, like going around Mars, the various space programs, and so forth, like the Super Collider to find the answers that Einstein could not find, I think these are exciting things that we should never throw away. And so I believe once we make that commitment, then the time lines that we have said, 2025, give us ample time to deal with this issue. And the fact that we are going to generate a minimal waste from this kind of a program is extremely important and one day will enter into the cost-benefit analysis.

Today, Mr. Moore is announcing, for example, work with the European Community in generating lifecycle costing of energy—we have never done that in the world—so we can compare apples and apples. Depending on what you are selling, you can cost it any way you want to, but so-called externalities for environmental costs and that sort of thing have never been properly costed. So we are in the middle of doing that.

And I think fusion will turn out to be a very cost- effective program because of the fact we use sea water, and the fact we do not generate much waste at the end of it, and we don't egregiously violate environment makes it a very attractive long-term item, and I hated to see the Congress cut it $50 million at the very time when we're about ready to go beyond a one-to-one conversion from power in/power out. So until we make a commitment, I really can not answer your question, nor do we get too excited about siting of such a thing. And we're talking a long time in the future but the milestones are the plasma physic experiment up at Princeton University, the International Thermonuclear experiment working with a consortium of major nations in Europe, including the Soviet Union, and Japan. That is underway right now and we need to be excited about that as a long-term hope to really get us off of a lot of these potentially damaging things if, in fact, global climate change turns out to link global temperature increase with greenhouse gases, which it has not done yet but it might, and so we better be ready for it, and Fusion is one of those answers. So I can only answer in general terms.

Mr. GILCHREST. Admiral Watkins, thank you very much.

Thank you, Mr. Chairman.

The CHAIRMAN. I didn't mean to cut you off, Mr. Gilchrest, just because I looked at you.

[Laughter.]

Mr. GILCHREST. I have a 12:00 appointment.

The CHAIRMAN. All right. I am, as you know, quite interested in fusion myself. The Admiral is correct in stating that we're at a critical juncture right now this year in determining whether we're serious or whether we're not serious about going ahead with fusion. And I hope you will continue your interest in it.

Mr. Wolpe.

Mr. WOLPE. Thank you very much, Mr. Chairman.

Mr. Secretary, I want to begin first by commending you for the manner in which you lay out your goals with respect to Federal energy R&D policy. On page 136 of the Energy Policy Statement, you indicate, and I quote, "One of the keys to ensuring future energy security is reduce the U.S. oil vulnerability. Technological advancements are one of the best ways to achieve this, and the National Energy Strategy calls for increased investments for technology research and development in areas with the greatest potential for reducing oil vulnerability." And then a page later, the same point is made as a goal, expand the role of advanced energy technology and reducing oil vulnerability.

What I want to kind of focus on for a moment is the extent to which that kind of statement of the goal meshes with the actual policy directions that are contained within the Strategy Statement. How much of our Nation's petroleum consumption is used in the generation of electricity?

Admiral WATKINS. Five percent.

Mr. WOLPE. Five percent.

Admiral WATKINS. Five percent. Very small.

Mr. WOLPE. That's why I get confused. The rhetoric that you've described in terms of the goal in energy R&D policy does not seem to match the policy proposal. Your fiscal 1992 budget submission contains two initiatives—the Advanced Light Water Reactor program and the Advanced Nuclear Reactor Concepts program, which would receive 46 percent of the proposed $134 million increase in DOE energy R&D dollars. In spite of your stated goal to refocus R&D efforts to displace petroleum, these technologies would produce nuclear electricity and, therefore, cannot effectively displace petroleum. How do you justify such as massive investment in a technology which fails to meet your own primary criteria for determining energy R&D investments?

Admiral WATKINS. Well, I think clearly you've got a good point in the sense that we do not have nuclear cars. On the other hand, we are moving very aggressively, as you know, in the electric vehicles. We are going to have to have power generation for electrical vehicles. Now today in the Nation we have peak power potential in our plants that could probably take care of 120 million cars. We have got 185 million cars on the road today in the United States. So we have plenty of backup potential in the off peak hours in the current power plants.

On the other hand, as time goes on—and the time frame we're talking about is really beyond 2010—we are talking about the need for electrical generation in this country that's very important. So I cannot tell you which electrons are coming from which power source, but we do need that electrical generation and our feeling is very strongly that if we're going to meet our projections on global environmental initiatives, we are going to have to find alternatives to fossil energy power generation and nuclear is our best answer. So that is why it is in here. It has a tangential link not as direct as the other elements that I have shown on figure 5. Surface transportation efficiency, air transportation efficiency, new transportation fuels are all displacing oil in the transportation sector and you'll see them all significantly enhanced, in fact, by 130 million over last year's appropriated budget up here. So that's a significant increase in research.

Mr. WOLPE. Well let's ignore then for a second the displacement of petroleum as the goal and talk about this need to increase demand for electricity in the years ahead. Your budget submission for fiscal year 1992 proposes to spend some $241 million for these advanced nuclear energy R&D programs. At the same time, you only chose $51 million on the photovoltaic program. How did you determine that the nuclear R&D programs are worthy of five times the funding level of the renewable source of electricity?

Admiral WATKINS. Well, we have different kinds of research dollars and at certain times in the developmental process the budgets are going to ramp up. When you get into nuclear power, for example, we have a major competition going on right now between the kinds of reactors that the Nation will build. So we are participating in that effort both on the defense side as well as the commercial reactor side.

The development part of the research can ramp dollars up where basic research may be $50 million. That's a significant amount of research, particularly since there's so much going on in the private sector. So we are coupled in collaboration with the private sector and academia on these things as well. It is hard to look at just dollars and saying we're not emphasizing something. I just do not agree with that.

Mr. WOLPE. Well, on page 140 of your report though you include this time line that you have up here for commercial introduction of selected energy technologies. This table predicts that the liquid metal reactor will be ready for commercial use between 2005 and 2010. According to your time line, utilities scale photovoltaics won't be ready for the commercial market until between 2010 and 2020. Would photovoltaics be ready for commercialization if they received as much R&D support as the nuclear technology?

Admiral WATKINS. No, sir, they would not or we'd do it. We look at the reality of what you can do. Now we threw a lot of dollars at Clinch River; we threw a lot of dollars at research as though that was going to produce a product. We are trying to be realistic about where we apply our dollars. We're talking about base load electricity and base load electricity reality says that 20 percent of our power in the country is going to continue to come from nuclear if we really work hard at it and solve all the problems we talked about earlier. So that's one element of it.

When you are talking about photovoltaics for baseload power generation, we are a long way from that. We have got a lot of work to do. I mean, we can generate megawatts; we're generating today some I think it's 5,000 megawatts in the country of solar. And that's perfectly fine for certain areas. But if we are talking about 700,000 megawatts, we're talking about growing, we've got to be realistic on what's possible in the near time frame, not just throw dollars at something and think that that is going to all of a sudden magically produce a result or we would try to do it. And I think in time you are going to see photovoltaics ramp up significantly. In fact, in our out years projections it goes up very high as we approach real demonstration of major power generation, such as 650 megawatt plants.

Mr. WOLPE. Well, Mr. Secretary, let me thank you for that response. My time is expired. My only point is that I wonder to what extent are we creating a self-fulfilling prophecy and whether or not an alteration of the kinds of investments we make at this stage will alter the time frames within which selected energy technologies would in fact emerge. I wonder if you could supply for the committee the documentation examining why you believe the photovoltaics cannot be commercialized at an earlier point in time.

Admiral WATKINS. We will do that, but we also want to encourage this Committee to be sensitive to the comprehensive nature of this report. If we do the R&D and the Congress continues to disallow plants in the renewable energy context to be penalized if they are over 80 megawatts, then we're making a mistake. So I have to have help in other areas or I can not achieve these. So in our Strategy we have a major regulatory reform which is essential to bring the kinds of things you're talking about on line in a real way; otherwise, we're going to be fooling around with four and five megawatt generators. So we need help across the board—it is not just in research and it is not just dollars; there are regulatory reforms that are essential or we're not going to facilitate the introduction of these new energy concepts into the mainstream. And that is going to be a tough fight up here on the Hill.

The CHAIRMAN. Thank you, Mr. Wolpe.

Mr. Rohrabacher.

Mr. ROHRABACHER. Mr. Secretary, first let me compliment you on your insistence on being realistic in how we use our taxpayers' dollars. Let me just note that the last time there was a National Energy Strategy we had another party in control of the Executive Branch and their strategy was basically to discourage energy production in the United States from traditional means and go off with more exotic synfuels, et cetera, which was basically flushing billions and billions of dollars right down the toilet and it was a total waste as it turned out. I am happy to see that—and you're going to get a lot of heat from what you're proposing today—but I can tell you, I think it is a pretty reasonable approach. There are some things that I'd like to see in here that aren't in here, but I would like to congratulate you and congratulate the Administration on laying out the foundation for a strategy. We will be working with you, I will be working with you, to see that we can actually accomplish something. So again, I appreciate you insisting on your realistic approach instead of just trying to grab headlines, which they tried in the late 1970s and it didn't end up helping the country at all.

One note. There is nothing that will create more conservation in this country than price. What we found out after the Carter Administration tried all their conservation measures, if they just would have allowed the price to go up on oil, there would have been an immediate pay-back to the society in the fact that people would concentrate on energy efficient cars, energy efficient appliances, et cetera. I know that you probably agree with that analysis. And I am sorry that this is rambling but I'll let you comment on whatever you want afterwards.

Again, also I would like to comment that I appreciate your commitment to fusion energy and looking to the future because with fusion and superconductivity we can create a new world, but it is going to create an investment in this realistic option for the world even though it is going to take a long time. And I compliment the Chairman and I am going to be working with the Chairman on this vital energy project because it will help create a new world.

And I am sorry, I guess I have just sort of filibustered here, but if you could just give me your reactions.

Admiral **WATKINS**. Well, I'd just like to say that I think that the fact that this Committee is dedicated to research development in science and technology, we need the pressure from the thinking on this Committee and committee like in the Senate to help us as we move through this period of time. As I say, this is a biannually update that is going to be required by the Congress. We are going to keep our energy modeling system going and improving it. The National Academy is trying to help us. And as time goes on, new discoveries are going to come into view that will transplant some of our thinking today, and we are going to be pushing very hard to ensure that research is focused in a way that can help the Nation.

And I believe that what we are doing in here is unusual in trying to stack these up in a way that says we know where we're going at least at this point in time in technology, and this Committee should help us be the honest broker over here on Capitol Hill in dealing with the myths and some of the hype that's going on where technology is really not being utilized for the decisionmaking process. I believe that the Science and Technology Committee can be very powerful of that regard, to say we have looked at the data, our staffs have looked at the data, and we can tell you that this seems reasonable or unreasonable. And we ought to try to work on that kind of a basis and I think then we will be doing our job, as the Chairman outlined earlier, being less constituency oriented on something that's so important to the Nation as a whole, that if we allow it to run in the fractionated way it has been run for 20 years, this country is not going to make it because embodied in here is the heart of our economic strength.

Mr. **ROHRABACHER**. Well, Mr. Secretary, you're comments about the hype that's involved in this issue are right on target. There was an offshore spill in my congressional district and it just happened to come from a tanker. And I stood there as hundreds of reporters tried to tell me that doesn't mean that we should then step back from offshore oil development. And they looked out and there was all this oil spilling out of a tanker onto my beaches and, of course, if we refrain from developing our offshore oil resources, that means we are going to be more dependent on tankers which are a riskier means of receiving our energy.

And speaking about that, let me ask you one question before my time is up. I noticed that there was something in the National Energy Strategy dealing with revenue sharing from offshore oil leasing—and this is something I'm an advocate of. Could you give us any details on that?

Admiral **WATKINS**. Let me ask Mr. Moore, who has been in the middle of that. He can talk, I think, better—

Mr. **MOORE**. There's discussed in the National Energy Strategy that we yet hope that legislation will come from the Administration that will deal with that subject. As we sit here at this very moment, it is still under consideration.

Mr. **ROHRABACHER**. Okay, well I am working on such legislation. Because if the local people are going to have their view disturbed, perhaps it would be better to enlist their support and try to get away from this nonsense, this absolutely irrational fear of offshore oil development by giving them some of the tax resources from that offshore oil development.

Thank you very much.

Admiral **Watkins**. Another thing that I would like to add is that when we get into vista, I think it is very important that we all understand what you might see between Los Angeles and Palm Springs as you drive out there on what I consider to be an environmental disaster, in wind machines that are standing still, stood still for years. And I think we've got to be a little cautious not all the homes are on Santa Barbara coast and if we sat in vista in the desert, which I love, and you like to sit in the desert, you do not like to look out on a thousand windmills that are worth considerably less than one derrick off the coast. So I understand what you're saying.

But I do think that the President has restricted certain areas until after the turn of the century; we can live with that very nicely. We have looked at the other areas that are not restricted, we don't see any potential to violate the environment in some of those areas where we may have as much as ten trillion cubic feet of gas which is now good. Environmentalists like it; we have to get it. We have to get to that gas if, in fact, we're going to use natural gas in that way.

We also have to wean ourselves off of oil and this is going to take some time; we do not do it overnight. So we have to have a transitional mode. And if we want at the same time to reduce our impact on this country of oil shocks in the future, and there will probably be some more, then we have got to move in that direction as well. So this strategy tries to do all of those things in a balanced way without trying to violate any environmental concerns. We are as tight on that issue as any other responsible member up here. We are environmentalists. We are trying to make energy generators environmentally conscious. And I think we have demonstrated our desire to do that in this Strategy.

Mrs. **Lloyd**. Time is expired.

Ms. Collins.

Ms. **Collins**. Thank you, Madam Chair.

Mr. Secretary, I am from Detroit and new to this Committee. I have two questions. I would like to give you both of the questions— Oh, by the way, Madam Chair, I would like my questions and remarks to be a part of the record.

I have two questions. I would like to give you both of my questions at the same time before you answer. The first one is your education component, investing in human resources. We've had hearings from NASA, NSF, all of them are talking about enhancing math and science education on the pre-college levels. None of them talk about giving money directly to the school districts. All of them have the same programs that we've had for the last 20 years that are not reaching the children of the inner cities. I am really fearful of the geniuses we are losing because they never have the opportunity to get involved in math and science. We have schools in the inner cities who use phys ed teachers to teach math or teach science. They need money to get the right kind of teachers teaching these very technological type of courses and they can't get it from taxes, they've tried all of those things. You have all this money on the Federal level and you are not giving any of it to the school districts. That's one.

The other question is you talk about two-thirds of the energy use is for cars and light trucks. But I don't see anything in this document for the proliferation of mass transportation, intercity and interstate. It seems to me that if we had a policy for light rail that we wouldn't have to wait 25 years for Maglev. You say that the cost of fuel is the best conservation tool. That doesn't help poor people who have to use transportation to get to and from their jobs. Why won't you or the Administration develop a mass transportation package to help those people in the cities get out to the jobs in the suburbs, or help those people who travel from State to State to rely on something other than air transportation or private autos?

Admiral WATKINS. Thank you, Ms. Collins. Let me talk about the first one and then I would like Ms. Stuntz to address the issue on the mass transportation in the Strategy.

As the Chairman knows, and we have sent up to Members of Congress, I, as chairman of the Federal Coordinating Committee on Science and Technology in the area of math and science education, we have produced a document which I think is very important. It is the first time that the President of the United States has ordered all of the Federal agencies that have skills based on math, science, and technology to come together and for the first time include in their Mission Statements the responsibility to help the Nation achieve its national goals set by the Governors and the President to be number one in math and science by the year 2000. So you see this is First in the World by the Year 2000 is the title. Inside there is an opportunity for the Detroit area, for example, to join with the adjacent Federal agencies that are listed in here in the variety of programs where our best scientists, our engineers, those of industry and business coupled with us, with the school districts, with the Governors come together for the first time and pull together the very best we can in the region.

Now I don't have a major facility in the Detroit area or I'd be with you right now on it. But we are in areas such as Chicago, we have a math and science academy there, we have funded that, the Congress has helped us fund that, and that's going to teach 15,000 math and science teachers in Chicago that now know nothing about math and science. And they are going to have to motivate the kids. So if I give dollars directly to the school districts and they don't know how to teach math and science, we're are not doing the job right. So what we're doing is refocusing the $2 billion in here in the various Federal programs to support the Department of Education and other initiatives, but focused on math and science specific $2 billion with heavy emphasis on pre- college. We're finally getting the message out there that youngsters can come in not only to these fields for vocations, but more importantly we can build a science literate society which it is not today.

So because the Federal Government only puts 6 percent of the education budget for the Nation into the private sector, it's peanuts in the scheme of things. In other words, 94 percent is coming from the private sector. But we can influence and we can lead, and that's what we're trying to do here. So I would like to have our people meet with you and see what Federal agency and how we might coordinate in the Detroit area to make a difference in the youngsters there growing up, both at the technician level as well as the baccalaureate and post-doctoral level. That's all in here. So we think this initiative is probably one that has really been fleshed out well in our Energy Strategy. And for the first time somebody is talking about the human resources to carry out this strategy which we never did before; we assumed that these people would be there and they won't. So that's why.

Now, on the issue of since two-thirds of the oil energy is consumed in the transportation sector, you're absolutely right on the mass transit approach. Now we have taken a number of initiatives into the National Energy Strategy on this issue. And I agree and would hope that we wouldn't have to wait for Magnetic Levitation as the only answer. And I don't know exactly what we at the Federal level can do because (1) it is not the research in those areas that are important, and this committee is dealing more into the high risk research areas, the longer things, with quite a bit of dollars now going into applied research as well, so some of that is applicable to other alternatives.

But I would like to have my deputy Henson Moore talk a little bit more about the mass transit program.

Mr. MOORE. Ms. Collins, just for instance, one of the things we do now is the fact this program calls for Executive action to increase the amount of money that goes tax free to an employee that's paid by an employer to ride mass transit. That's something that's in this program right now the President will be doing without the changes in law. There are a number of other areas that we work in.

You made a comment, and I want to be sure we correct the record, the Administration is not the one that suggested that price is the best way to solve the energy problem. You heard that from some of your colleagues on the committee. The President does not agree with that. He, therefore, opposed all import fees for that reason, he opposed carbon taxes for that reason, he opposed gasoline taxes for that reason, is because they do strike at the people in this country who are the least able to pay those taxes. And so I think we're in sync with you about how to go about solving the problem. And I agree with the Admiral, the thing to do is for our staff to spend time with yours showing you what is in here, and certainly we'd be more than happy to get your results back or your comments back.

Ms. COLLINS. Okay. When I read on your mass transportation—

Mrs. LLOYD. Ms. Collins, I believe your time is expired. We are going to try to get the Secretary up pretty soon.

We're going to recognize Mr. Packard, and wind up.

Mr. PACKARD. I'll be very short, Mr. Secretary. I would like to first express my deep appreciation for the professional and the comprehensive report and strategy you've given us. I have been waiting for more than a decade for a National Energy Policy. I think that you've done a remarkable job and I appreciate it and I hope the committee will work with you on it.

I have one simple questions and hopefully it will be short. You've mapped out a 30 to 40 year plan for energy, and I think that's very commendable. As you know, most of our strategies and our plans are driven by budgets. Have you given thought to whether the budget strategy—or any strategy for budgeting such a plan and how much is your plan dependent upon a long-term budget strategy?

Admiral **Watkins**. It's very dependent, Mr. Packard. And I think one of the things we need to work with you on is how do we stabilize an R&D budget that supports let's say the final agreed to National Energy Strategy. I think once we get through this session of Congress, and hopefully we'll come up with an approved bill that both the Congress and the President are satisfied with, then we should sit down and say let's have some stability at least in the forthcoming five year program and disallow this ups and downs that we get on some of the last minute major incursions into these dollars. That program of fusion I talked about was hit so hard last year that it is questionable whether we can recover. And I think we can't stand those kinds of things.

So I hope that this committee, again, will help us strengthen the resolve up here on the Hill to hold certain things that we've agreed to in an energy policy for the Nation somewhat sacrosanct in research over the near term and then we can upgrade it every couple of years. But certainly we ought to be able to say let's stabilize this thing and not have fits and starts where scientists get discouraged that there simply is no future for them. I think that's very important.

Mr. **Packard**. That's my concern is that we budget on a year-to-year basis and you've developed a long-term plan and we don't have a budget to—I'll yield to the ranking member, Mr. Walker.

Mr. **Walker**. Thank you. I appreciate the gentleman yielding. I just wanted to make a couple of statements here before I had to leave.

You have testified on several occasions here today in response to questions about your efforts in the conservation area. I would point out to the Committee that what you propose to spend is 24 percent more on energy conservation and renewables under the jurisdiction of this Committee than what we allocated for 1992 in our authorization. So you are I think a way in front of this Committee.

I would also praise you in what you've done in energy strategy, and my opening comments, which I didn't do to defer to questions, will indicate this. But I would praise you for not going the totalitarian approach to energy and making people buy cars they don't want to buy or making them pay prices they don't have to pay. I mean, I think the essence of your policy is a good one.

I want to put in the record at this point a Congressional Research study that I had done to indicate why the CAFE standards may be a bit of a problem. For example, under CAFE, we suffered a 13 percent drop in American market share of automobiles sold while we had a 59 percent increase in import market share, which translated to 150,000 Americans who lost their jobs as a result of CAFE. The American manufacturers lost 25 percent of their manufacturing facilities while foreign manufacturers had an 800 percent increase in their manufacturing facilities in this country. It seems to me that that is something that we ought to take into account when we start talking about CAFE standards that may wreak further havoc on the American automobile industry and not get us the kind of solutions we have.

So I appreciate the gentleman yielding because I did want to get a couple of comments in to indicate to you that I think you've done a magnificent job in putting forward an Energy Strategy.

Admiral WATKINS. Thank you.

Mr. WALKER. I thank the Chairman.

Mrs. LLOYD. I thank the gentleman from Pennsylvania.

We have some members that were not recognized and, again, I apologize. You will be recognized first when we have our second hearing. But I would like to members for unanimous consent.

Mr. Roemer.

Mr. ROEMER. Thank you, Madam Chairperson.

I would just like to bear with the committee for 30 seconds. First of all, as a new member, I appreciate the excellent testimony of all three. I ask unanimous consent to have all my questions submitted for the record.

Mrs. LLOYD. Without objection.

Mr. ROEMER. I welcome back a former colleague, especially from my father-in-law's State, and I put in a quick plug to invite you, Mr. Secretary, as the chairperson on the Committee of Education and Human Resources, to both visit an ethanol plant in my district and—

Mrs. LLOYD. The gentleman's time is expired.

Mr. ROEMER. And encourage our young people to get involved in—

Mrs. LLOYD. The gentleman from Texas, Mr. Hall.

Mr. HALL. Thank you, Madam Chairman.

Since the Admiral is flanked by Congressman Moore and Linda Stuntz, and we all know we have access to them and reliable access to them, we'll submit our questions to them and let the Admiral go.

The CHAIRMAN. And Mr. Geren.

Mr. GEREN. I thank you, Madam Chairman.

I want to thank the Admiral and Mr. Moore for their testimony, and I would like unanimous consent to submit some questions to the record and ask their consideration of them in reply.

Mrs. LLOYD. Without objection, they will be included in the record.

Again, Mr. Secretary, thank you for your outstanding testimony. It is always a privilege to be with you. We admire you and respect you and look forward to working with you and your distinguished colleague, your Assistant Secretary Henson Moore.

If there are no further comments, the Committee stands adjourned.

[Whereupon, at 12:36 p.m., the Committee adjourned, to reconvene at the call of the Chair.]

APPENDIX I

OPENING STATEMENT OF CONGRESSMAN GEORGE E. BROWN, JR.

HEARINGS ON THE PROPOSED NATIONAL ENERGY STRATEGY

FEBRUARY 26, 1991

Today we are holding the first of two hearings to explore what should be included in a National Energy Strategy. This morning we will be hearing from Admiral James Watkins, the Secretary of Energy, who will present the Administration's proposal for a National Energy Strategy. On Thursday, February 26, 1991, we will be hearing from a distinguished panel of national leaders in the field of energy to explore their views of national energy policy needs.

I have reviewed the Administration's National Energy Strategy and would like to compliment them for what has been a long and, according to press reports, difficult process. The public debate which has been started by this effort is long-overdue and I welcome the Department of Energy's leadership and participation in this debate. There are even a few specific proposals in their proposed National Energy Strategy which I find acceptable, which is either a tribute to Secretary Watkins' work or a statement of my having been worn down by past energy policy debates.

What we are starting today is a comprehensive review of our national energy programs and policies with an emphasis on the research and development (R&D) programs under this Committee's jurisdiction. We have at least two subcommittees with direct jurisdiction over energy R&D programs to whom this issue will be given for further, detailed consideration in coming weeks. I look forward to the leadership of Mr. Scheuer and Mrs. Lloyd as their respective subcommittees finish the examination we are starting today. Following this process, we expect to bring the issue back to the full committee in the form of an energy research and development authorization bill which can move alone or as part of a larger piece of legislation. It is our hope to have this process completed by late spring.

I do not have any pre-conceived notion of what will constitute an adequate energy R&D authorization package. I have a number of biases about what is needed and a number of biases about what has been proposed in, or left out of, the Administration's program released last week. I will try to temper my biases with the need to secure passage of legislation which will address this long-neglected issue.

However, I will not support any legislative package, especially in the energy R&D area, that does not anticipate a steady level of funding support. We have let too many vital energy R&D programs languish over the last decade and now, when we need answers, we find that we have to restart many of our research efforts at great expense and delay. Our lack of energy research funding in critical areas over the last decade has resulted in a lost decade of effort.

With those comments, I would like to welcome Secretary Watkins to the House Science, Space, and Technology Committee and will recognize other members for their brief opening remarks.

Statement of
Representative Dan Glickman
before the House Committee on
Science, Space and Technology

February 26, 1991

Secretary Watkins, thank you for taking the time to appear before the Committee this morning. I have some serious reservations about the content of the President's recently released National Energy Strategy. This long-awaited policy is fatally flawed, and is largely political pabulum. We have an energy dependence problem in this country. You suggest increasing supply rather than cutting demand, which is like sending an alcoholic to the local bar for treatment instead of Alcoholics Anonymous. Unfortunately, President Bush ignored the advice of his energy experts which was included in the first draft of the National Energy Policy, and instead listened to his top political advisors.

This proposal is severely unbalanced because it ignores the need for the United States to curb our consumption of oil through conservation measures, and instead looks to high risk, expensive propositions such as opening up the Artic National Wildlife Refuge to oil and gas leasing and offshore drilling on the outer continental shelf.

The Administration policy lacks two measures I feel are vital to revitalize oil and gas production in the lower 48 states. Those measures are a tariff on imported oil and a price floor on oil. Guaranteed price stability would help revitalize our sagging domestic oil production. The economic hardships experienced by the oil and gas industries in my own state of Kansas compel me to view the President's National Energy Strategy as an inadequate solution to a problem that has plagued the oil and gas industries for the last decade. Current U.S. oil production is at its lowest level in 25 years, and domestic oil production has steadily declined from 9 million barrels per day (BPD) to 7.3 million BPD in the last 5 years alone. U.S. oil and gas producers need some long-term assurances that the government will concentrate on the production capabilities in the lower 48 states, rather than raiding Alaska or U.S. coastlines for easy access to oil.

I believe it is possible to stimulate the oil industry while encouraging America's energy independence at the same time. The steady erosion of our domestic oil and gas industry has alarming implications not only for our nation's energy security but for for our balance of payments deficit as well. Almost fifty percent of the oil we consume is produced in foreign countries and, without definitive action, that figure is likely to increase to 70 percent by the turn of the century.

The most glaring omission in the energy policy is the lack of an increase in automobile fuel efficiency through an increase in corporate average fuel economy (CAFE) standards. The world is at war in part, because of our dependence on petroleum from the Persian Gulf states. The United States cannot leave itself so vulnerable again. The imposition of CAFE standards and the response of automobile manufacturers to meet those standards more than doubled the fuel economy for passenger cars since 1975. Nonetheless, passenger cars and light trucks alone still account for 40 percent of United States oil consumption. We must address the enormous use of oil in the transportation sector of the economy. Improving the fuel efficiency of the cars and trucks we drive is the most reasonable and least complicated thing we can do as a nation to wean ourselves off our unprecedented consumption of foreign oil.

New CAFE standards will build on improvements in fuel efficiency and will do the most to further our goal of U.S. energy security. I have introduced legislation, H.R. 612, which requires each automobile manufacturer to increase CAFE standards by 25% in 1996 and by 50% in 2001. The savings of nearly 3 million barrels of oil per day would more than offset the amount of oil imported into the United States each day from the Persian Gulf.

According to a recent poll sponsored by the Alliance to Save Energy and the Union of Concerned Scientists, eighty-four percent of the respondents support increasing federal fuel economy standards to 40 mpg by the year 2000. Thus far, it appears the American people possess the vision for our energy future the Bush Administration lacks, since the National Energy Strategy does absolutely nothing to address the issue of fuel efficiency.

It is unfortunate the Administration chose to submit a package that is pure pabulum because it ignores the most obvious and effective ways to achieve energy independence. It is now up to Congress to take action and implement real solutions to reduce our consumption of foreign oil and preserve our country's valuable resources for the future.

MICHAEL J. KOPETSKI
5TH DISTRICT, OREGON

Congress of the United States
House of Representatives
Washington, DC 20515

FEBRUARY 26, 1991

OPENING STATEMENT

NATIONAL ENERGY STRATEGY HEARING

Mr. Chairman, thank you for scheduling this very important hearing. Admiral Watkins, thank you for coming to the hill today to share with this committee the National Energy Strategy.

Admiral Watkins, over the eighteen month period that the NES was formulated I believe that you approached your work with America's best interests at heart. For this you have my respect and admiration. However I do not believe the National Energy Strategy that the Administration is now proposing has America's best interests at heart. The NES is woefully short on conservation proposals and will not change America's approach to energy. Sure we will need to tap new energy supplies, but to turn to increased production as a first step is not in America's best interest and sends the wrong message to American citizens with respect to the importance of conservation in our society.

I believe the National Energy Strategy "strikes out" on it's biggest opportunity to serve the best interests of this nation. That is to treat conservation as an energy resource in and of itself. In the Northwest this idea has caught on and is already saving consumers money. Bonneville Power Administration has spent $1 billion on conservation measures in the last 10 years, thereby delaying the need for more energy production facilities.

Oregon State University in conjunction with the Department of Energy has assisted 98 small manufacturers in implementing energy saving measures resulting an annual savings of $5 million. In Marion County alone, the Oregon Department of Energy through loans, grants, rebates and tax credits has helped to stimulate more than $33.4 million in economic activity. The investor owned utilities in my district also realize that offering energy efficiency is good business. I look forward to discussing with Admiral Watkins how the National Energy Strategy regards conservation as an energy resource and to urge the Administration to give it additional attention.

In short, conservation should be the first and second steps we take in our national energy policy, that's how important a priority it should be.

Finally, yesterday I saw a public service announcement on television concerning more efficient use of gasoline. The voice said President Bush wanted us to check our tire pressure to enable us to get more miles to the gallon. Is this the leadership that the environment President has indicated on numerous occasions that he wants to provide? This is not leadership, it is a failure to realize the energy problems facing our country today.

Ron Packard

STATEMENT OF
THE HONORABLE RONALD C. PACKARD
REPRESENTING THE 43RD DISTRICT OF CALIFORNIA
BEFORE THE
HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
FEBRUARY 26, 1991

I AM VERY PLEASED WITH PRESIDENT BUSH'S PRESENTATION OF A NATIONAL ENERGY STRATEGY LAST WEEK. EVENTS IN THE PERSIAN GULF HAVE ONCE AGAIN EMPHASIZED THE NEED FOR THE UNITED STATES TO ESTABLISH GREATER ENERGY INDEPENDENCE. TO THIS END, THE BUSH ADMINISTRATION HAS DEMONSTRATED A COMMITMENT TO ACHIEVING GREATER ENERGY SECURITY. THE NATIONAL ENERGY STRATEGY, FOR THE FIRST TIME IN OUR NATION'S HISTORY, LAYS A COMPREHENSIVE FOUNDATION FOR A MORE EFFICIENT, ENVIRONMENTALLY SENSITIVE, AND SECURE ENERGY FUTURE.

AS THE ENERGY NEEDS OF OUR NATION CONTINUES TO GROW, WE MUST RECOGNIZE THAT THERE IS NO SINGLE, SIMPLE SOLUTION TO OUR ENERGY PROBLEMS. IT IS ESSENTIAL THAT WE EXPLORE AND DEVELOP ALL PRESENT AND FUTURE ENERGY SOURCES. WE KNOW FROM EXPERIENCE THAT IT IS IMPOSSIBLE TO SOLELY CONSERVE OR PRODUCE OUR WAY TO A SECURE, VIABLE ENERGY PROGRAM. WE NEED TO DO BOTH, AND WE NEED TO DO IT IN A WAY THAT WILL NOT CRIPPLE OUR ECONOMIC VITALITY. THE SUCCESS OF LAST YEAR'S CLEAN AIR ACT AMENDMENTS DEMONSTRATED THAT ENVIRONMENTAL NEEDS CAN BE BALANCED WITH THE NEED TO PROTECT JOBS AND THE CONSUMER'S POCKETBOOK.

THE DEVELOPMENT OF ALTERNATIVE FUELS IS OF PARTICULAR INTEREST TO ME. CURRENTLY, OVER SIXTY-THREE PERCENT OF U.S. PETROLEUM FUEL CONSUMPTION IS USED FOR TRANSPORTATION NEEDS. IMAGINE THE TREMENDOUS ADVANTAGES WE WOULD GAIN IF WE COULD SIGNIFICANTLY

DECREASE OUR USE OF FOSSIL FUELS AND INCREASE OUR USE OF OTHER CLEANER, RENEWABLE SOURCES OF TRANSPORTATION FUELS.

AS YOU KNOW, MY DISTRICT IS CURRENTLY A NON-ATTAINMENT AREA FOR CLEAN AIR. THE DEVELOPMENT AND USE OF ALTERNATIVE FUELS WOULD NOT ONLY HELP TO MEET OUR ENERGY NEEDS, BUT IT WOULD HELP MY DISTRICT ATTAIN CLEAN AIR. AS AN EXAMPLE OF THIS, WE RECENTLY RECEIVED WORD THAT THE NORTH COUNTY TRANSIT DISTRICT RECEIVED A GRANT AWARD TO PURCHASE ELEVEN CNG (COMPRESSED NATURAL GAS) BUSES. THIS WILL HELP MY DISTRICT MEET CLEAN AIR REQUIREMENTS AND WILL DEMONSTRATE THE FEASIBILITY OF THE INCREASED USE OF ALTERNATIVE FUELS.

ON A FINAL NOTE, I AM PLEASED THAT THE NATIONAL ENERGY STRATEGY RECOGNIZES THE IMPORTANCE OF DEVELOPING A COOPERATIVE EFFORT AMONG THE GOVERNMENT, INDUSTRY, SCIENCE, AND THE AMERICAN PEOPLE. BY INVESTING IN AMERICAN KNOW-HOW AND INGENUITY, INSTEAD OF RELYING ON COMMAND AND CONTROL MEASURES SUCH AS INCREASED GOVERNMENT REGULATIONS AND TAXES, WE CAN REDEFINE AMERICA'S ENERGY FUTURE THROUGH SHARED RESPONSIBILITY.

OPENING STATEMENT

BY U.S. REP. JERRY F. COSTELLO
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
COMMITTEE HEARING - NATIONAL ENERGY STRATEGY
FEBRUARY 26, 1991

Mr. Chairman, today we welcome our very distinguished witness, Secretary Watkins, to discuss the direction and objectives of national energy strategy, and some of the key policy recommendations.

As we consider the problems of increased energy demand and energy dependence, it is my hope that during this two-hearing schedule we will began to look at moving away from the heavy reliance on imported oil.

Today and Thursday will provide a broad perspective to advancing the development of a comprehensive national energy policy. I look forward to hearing from Secretary Watkins as we move forward on an authorization bill for DOE.

Mr. Chairman, I thank you for calling this hearing and I anticipate some interesting and relevant commentary by our distinguished witnesses.

OPENING STATEMENT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
NATIONAL ENERGY STRATEGY
FEBRUARY 26, 1991

Constance Morella

Mr. Chairman, I extend a warm welcome to Secretary Watkins today, and I am eager to hear from him about the Administration's National Energy Strategy. I am pleased with many elements of the proposal: the increased participation of the federal government in technology transfer, especially the ability of the United States to copyright computer software, the promotion of renewable energy resources by extending the tax credit on solar and geothermal business; the reduction of oil consumption by the use of alternative fuel vehicles in commercial fleets and the encouragement of commuter van-pools and public transit by allowing tax-exempt commuter subsidies by employers; increased research and development for renewable technologies such as solar, wind, biomass and geothermal; increased research and development on innovative building materials and designs; and the improvement of precollege science and mathematics education.

However, I look for changes in some proposals. I would hope that instead of reliance on drilling, Americans would be encouraged to make changes in our energy use. Americans often need a crisis to spur us on to action, and, certainly, the war in the Middle East presents such an opportunity to urge greater conservation measures.

In the days ahead, I look forward to working with the U.S. Department of Energy and my colleagues in the Congress to legislate energy policy that encourages increased energy efficiency and conservation, while providing for national energy security.

APPENDIX II

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

CRS

Congressional Research Service • The Library of Congress • Washington, D.C. 20540

Memorandum September 21, 1990

TO : Honorable Robert S. Walker
Attention: Bill Wichterman

FROM : Gwenell L. Bass
Analyst in Industrial Organization and Corporate Finance
Economics Division

SUBJECT : Background Information on the Automobile Industry

This memorandum is in response to your request for information on the automobile industry. You specifically asked for data on domestic manufacturers market share as well as statistics on corporate average fuel economy standards. You also requested employment information and the number of automobile factories in the United States.

Table 1 lists annual U.S. passenger car retail sales for the years 1970-1989. Domestic and foreign sales are also shown. Automobile sales peaked in 1986 at 11.5 million units, surpassing the previous high of 11.4 million units reached in 1973. Total automobile sales have been declining every year since 1986, except 1988, when passenger car sales increased approximately 2 percent. Imported car sales also peaked in 1986; since then imports have steadily declined.

Corporate average fuel economy (CAFE) standards are listed in table 2. The table lists fuel economy estimates for the domestic fleet as well as for imported passenger cars. As indicated in table 2, 1984 was the first year that combined domestic-import average fuel economy ratings did not meet CAFE standards. The 1984 new car total fleet rating was 26.9 miles per gallon (mpg) which was slightly below the 27 mpg Federal standard.

Average new car fuel economy has declined for the last two model years (MY). The Environmental Protection Agency (EPA) said that an increase in heavier, more powerful cars was responsible for the drop in the efficiency of domestic and imported passenger cars to 28.2 mpg for 1990 MY from 28.3 mpg in 1989. The fuel efficiency of passenger cars peaked in 1988 at 28.7 mpg. As indicated in table 2, the 1990 level of 28.2 mpg rolls back the fuel economy to the 1986 level.

TABLE 1. Annual U.S. Passenger Car Retail Sales (1970-1989)
(units in thousands)

Year	Domestic	% of Total	Imports	% of Total	Total
1970	7,119	84.7	1,285	15.3	8,405
1971	8,681	84.7	1,568	15.3	10,250
1972	9,327	85.2	1,623	14.8	10,950
1973	9,676	84.6	1,763	15.4	11,439
1974	7,454	84.1	1,413	15.9	8,867
1975	7,053	81.6	1,587	18.4	8,640
1976	8,611	85.2	1,498	14.8	10,110
1977	9,109	81.4	2,076	18.6	11,185
1978	9,312	82.3	2,000	17.7	11,312
1979	8,341	78.2	2,329	21.8	10,671
1980	6,578	73.3	2,395	26.7	8,973
1981	6,206	72.7	2,327	27.3	8,533
1982	5,759	72.2	2,222	27.8	7,981
1983	6,795	74.0	2,386	26.0	9,181
1984	7,951	76.5	2,442	23.5	10,393
1985	8,205	74.3	2,838	25.7	11,042
1986	8,215	71.7	3,245	28.3	11,460
1987	7,081	68.9	3,197	31.1	10,278
1988	7,526	71.1	3,065	28.9	10,591
1989	7,073	71.7	2,795	28.3	9,867

Note: Domestic sales include unit sales of foreign transplants that are built in the United States.

Source: Motor Vehicle Manufacturers Association. *Motor Vehicles, Facts and Figures 1988*; *Automotive News -- 1988 Market Data Book*; and *Automotive News*, January 8, 1990.

TABLE 2. New Car – 50 State Corporate Average Fuel Economy
1974–1990
(City/Highway Miles Per Gallon Rating)

Model Year	Federal Standard	Domestic Fleet	Import Fleet	Total Fleet
1974	None	13.2	22.2	14.2
1975	None	14.8	23.3	15.8
1976	None	16.6	25.4	17.5
1977	None	17.2	27.7	18.3
1978	18.0	18.7	27.3	19.9
1979	19.0	19.3	26.1	20.3
1980[a]	20.0	22.6	29.6	24.3
1981	22.0	24.2	31.5	25.9
1982	24.0	25.0	31.1	26.6
1983	26.0	24.6	32.2	26.4
1984	27.0	25.6	31.8	26.9
1985	27.5	26.3	31.5	27.6
1986	26.0[b]	26.6	31.7	28.1
1987	26.0[c]	27.0	31.1	28.4
1988	26.0[c]	27.3	31.2	28.7
1989 (est.)	26.5	26.9	30.7	28.3
1990	27.5			

[a] After 1979, domestic fleet does not include captive imports.

[b] NHTSA revised 1986 standard on October 4, 1985.

[c] NHTSA revised 1987 standard on October 6, 1986.

Source: U.S. Department of Transportation and published and unpublished data from Environmental Protection Agency.

Table 3 contains employment data for Standard Industrial Classification 371 which includes workers in the motor vehicles and equipment industry. The employment data are divided into two categories: all employees and production workers. Employment in the motor vehicle and equipment industry peaked in 1978 with 1,004.9 thousand workers. Employment began declining in 1979 and hit a low of 704.8 thousand workers in 1982. However, it is important to remember that 1982 was the year in which the United States experienced the worst economic down turn since the Great depression. Employment increased every year between 1983 and 1985. The number of workers in the industry declined between 1986 and 1988. Employment in the motor vehicle and equipment industry is expected to continue to increase, as foreign carmakers and parts manufacturers set up shops in the United States.

TABLE 3. Employment Statistics for the Motor Vehicle and Equipment Industry SIC 371
1970-1987

Year	Total Motor Vehicle & Equipment Workers (thousands)	Total Motor Vehicle & Equipment Production Workers (thousands)	Average Hourly Wages for Motor Vehicle Production Workers (dollars)	Average Hourly Wages for All Production Workers (dollars)
1970	799.0	605.3	$4.22	$3.23
1971	848.5	655.4	4.72	3.45
1972	874.8	676.0	5.13	3.70
1973	976.5	754.9	5.46	3.94
1974	907.7	687.5	5.87	4.24
1975	792.4	602.4	6.44	4.53
1976	881.0	682.4	7.09	4.86
1977	947.3	734.7	7.85	5.25
1978	1,004.9	781.7	8.50	5.69
1979	990.4	764.4	9.06	6.16
1980	788.8	575.4	9.85	6.66
1981	788.7	586.0	11.02	7.25
1982	704.8	515.8	11.62	7.68
1983	753.7	568.4	12.14	8.02
1984	861.7	664.1	12.73	8.32
1985	876.4	679.4	13.42	8.57
1986	843.0	646.8	13.53	8.76
1987	841.5	654.5	13.57	8.98
1988	849.7	662.2	13.57	9.29
1989	855.8	661.4	14.28	9.66

Source: U.S. Department of Labor. Bureau of Labor Statistics.

U.S. car manufacturing assembly facilities are listed in table 4 by company for model years 1970 -1990. Foreign-owned car manufacturing facilities in the United States are listed in table 5. The first year listed for a foreign-owned plant is the year that the company started producing in the United States.

TABLE 4. U.S. Car Manufacturers
Assembly Facilities by Model Year
1970–1990

	Company				
Year	American Motors	Chrysler	Ford	General Motors	Total
1970	1	7	15	23	46
1971	1	7	15	22	45
1972	1	6	15	22	44
1973	1	6	15	22	44
1974	1	6	14	22	43
1975	1	7	14	22	44
1976	1	8	14	22	44
1977	1	7	14	22	44
1978	1	7	14	22	44
1979	1	6	13	23	43
1980	1	5	13	23	42
1981	1	5	11	23	40
1982	1	4	10	23	38
1983	1	4	10	20	35
1984	1	6	9	22	38
1985	1	6	8	21	36
1986	1	6	8	25	40
1987	1	6	8	24	39
1988[a]	–	6	8	24	38
1989	–	6	8	21	35
1990	–	5	8	21	34

[a] American Motors was acquired by Chrysler in 1987.

Source: *Automotive News* Market Database. Various years.

TABLE 5. Foreign-owned Car Manufacturers
Assembly Facilities by Model Year
1979–1990*

Year	Company								Total
	Diamond Star	Honda of America	Mazda Motor	New United Motors	Nissan	Subaru-Isuzu	Toyota	Volkswagen	
1979	–	–	–	–	–	–	–	1	1
1980	–	–	–	–	–	–	–	1	1
1981	–	–	–	–	–	–	–	1	1
1982	–	–	–	–	–	–	–	1	1
1983	–	1	–	–	–	–	–	1	2
1984	–	1	–	–	–	–	–	1	2
1985	–	1	–	1	1	–	–	1	4
1986	–	1	–	1	1	–	–	1	4
1987	–	1	–	1	1	–	–	1	4
1988	–	1	1	1	1	–	–	1	5
1989	1	1	1	1	1	–	1	–	6
1990	1	2	1	1	1	1	1	–	8

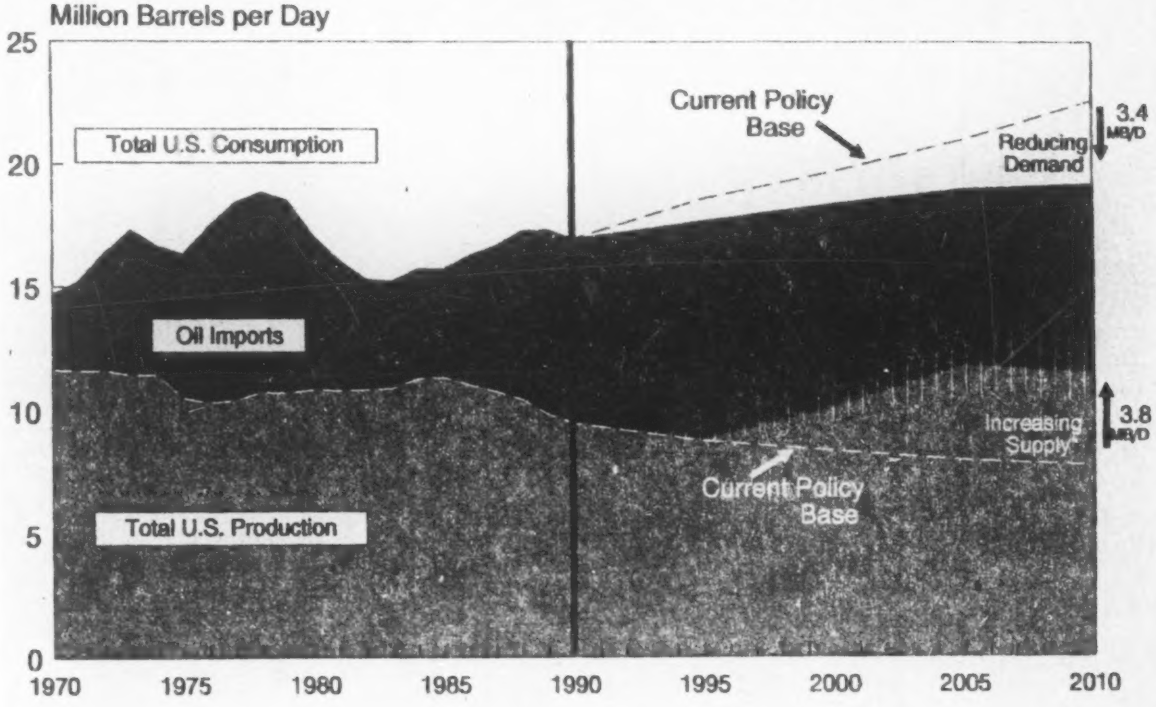
* The first year listed for a plant is when that company started producing in the United States.

Source: *Automotive News* Market Data Base. Various years.

As I indicated in our telephone conversation, we were unable to find a reference to your quote that the Japanese Ministry of International Trade and Industry (MITI) stated that Japan would never be successful in the United States domestic automobile market.

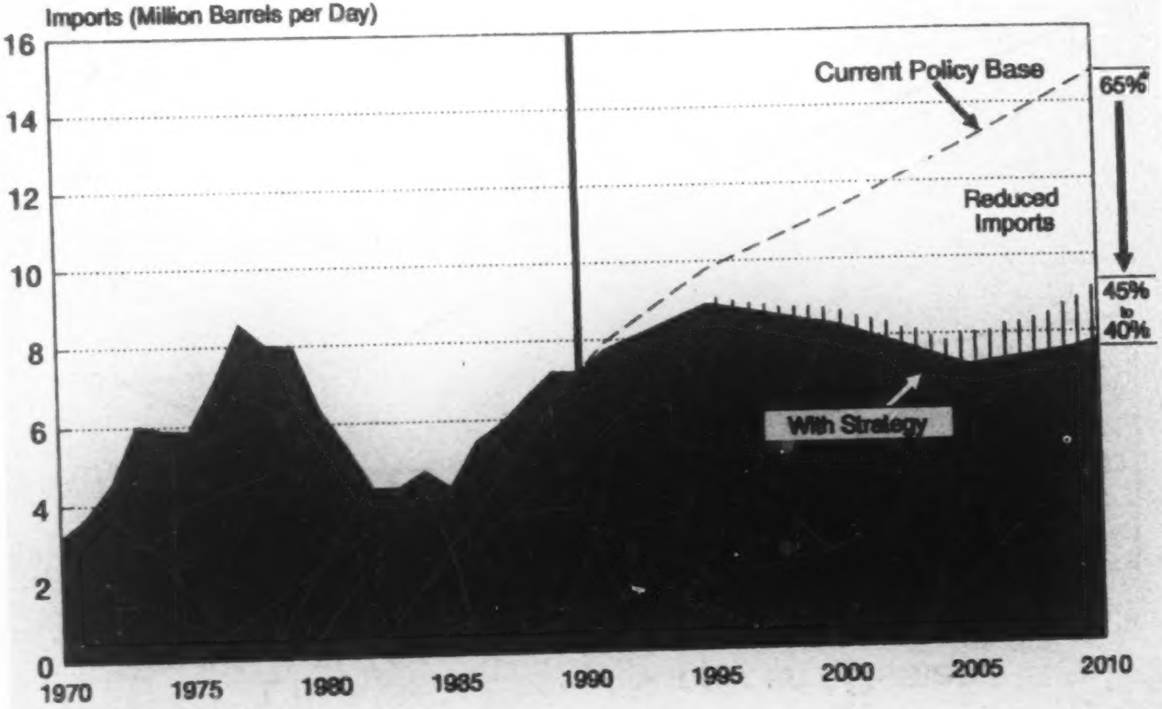
If we can be of further assistance please call 7-7300.

Effects of the National Energy Strategy
on U.S. Oil Consumption and Production



*Production range represents uncertainty associated with R&D

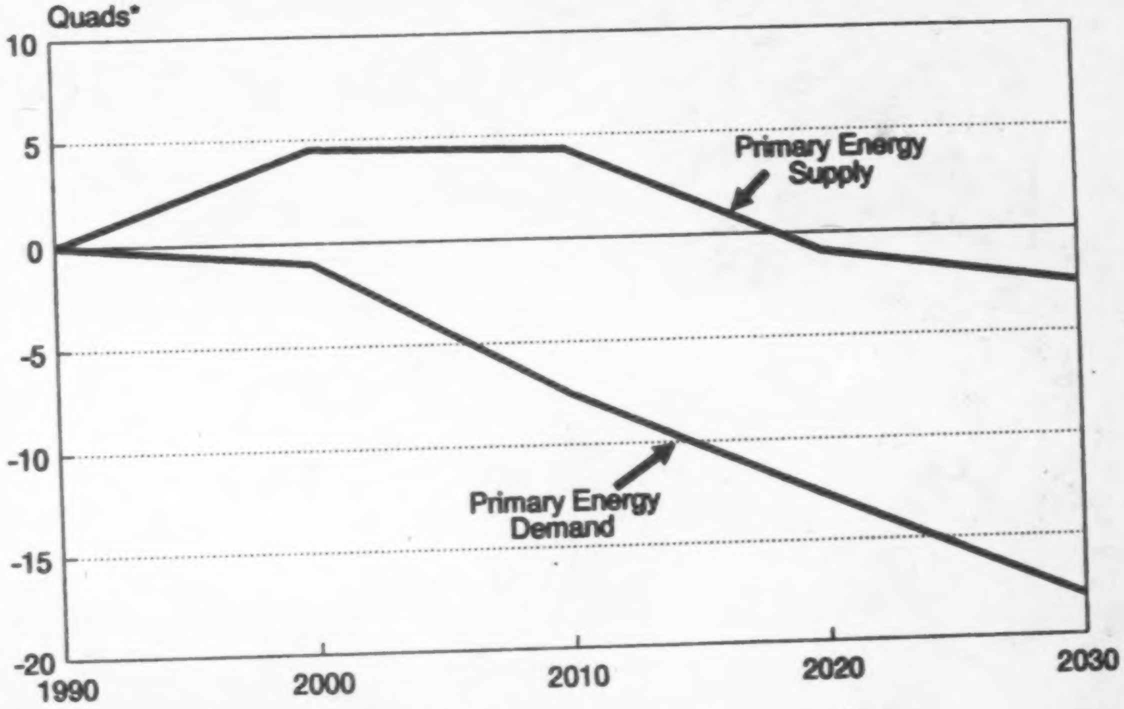
Reduced Oil Imports



*Note: Imports as percent of total oil consumption.

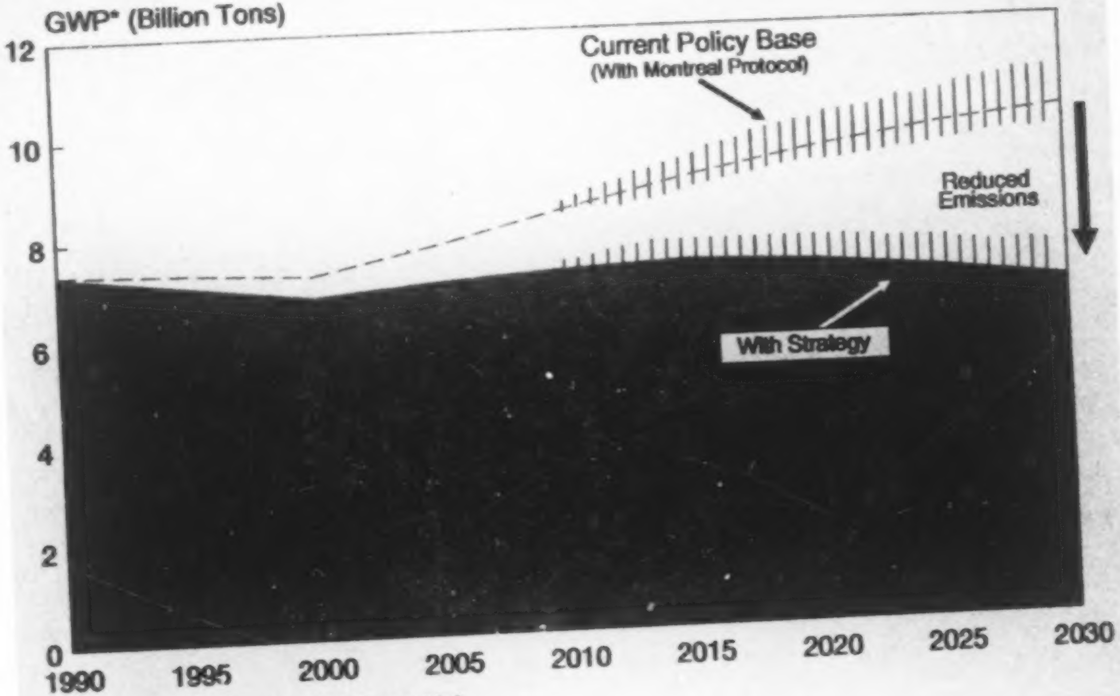
Effects of the National Energy Strategy

Changes in Energy Supply and Demand



*Note: 1 Quad is equivalent to about 500,000 barrels of oil per day for one year.

Reduced Potential for Global Warming



* Global warming potential(GWP)- Unit of 100-year global warming potential measured in billion metric tons CO2 equivalents. Greenhouse gases vary in lifetimes and ability to absorb and radiate heat, therefore a common unit is used.

National Energy Strategy

Estimated Results in 2010

- Reduces oil imports from 65 percent to between 40 percent and 45 percent.
- Reduces oil use by 3.4 million barrels per day and increases domestic oil production by 3.8 million barrels per day.
- Increases electricity produced from renewable sources by 16 percent.
- Increases use of alternative transportation fuels and technology by up to 3 million barrels per day.
- Reduces U.S. emissions of greenhouse gases at or below 1990 levels.
- Saves consumers more than $90 billion in energy costs (1989 dollars).

Figure 5.

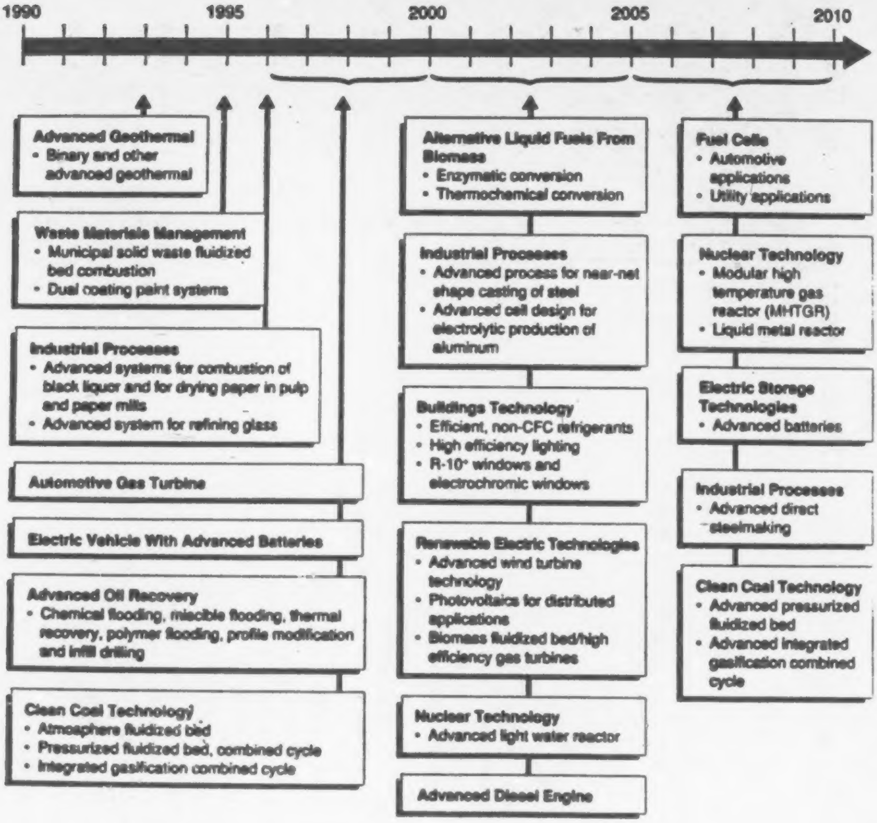
Enhanced Research & Development for Energy Security

Initiative	Budget Authority (millions of dollars) 1991 Enacted	1992 Proposed	Dollar change	Percentage change
Surface transportation efficiency	162	260	+98	+60
Improved vehicle propulsion technology	39	42	+3	
Electric/hybrid vehicles	30	42	+12	
Intelligent vehicle-highway systems	23	60	+37	
High-speed rail and magnetic levitation	12	24	+12	
Telecommuting	58	92	+34	
Air transportation efficiency	51	59	+8	+16
Energy-efficient aeronautics	16	17	+1	
Efficient air traffic control	35	42	+7	
New transportation fuels	89	113	+24	+27
Fuels from biomass	33	44	+11	
Alternative fuel utilization	14	17	+3	
Advanced oil recovery	42	52	+10	
Total, Displacing oil in the transportation sector	**302**	**432**	**+130**	**+43**
Targeted industrial energy efficiency	84	102	+18	
Targeted buildings energy efficiency	45	55	+10	
Total, Increased energy efficiency in buildings and Industry	**129**	**157**	**+28**	**+22**
Photovoltaics	47	51	+4	
Superconductivity	19	22	+3	
Advanced light-water reactors	29	63	+34	
Advanced reactor concepts	150	178	+28	
Total, Advanced electricity technology	**245**	**314**	**+69**	**+28**
***Total, all activities**	**676**	**903**	**+227**	**+34**
Total, Department of Energy	**519**	**653**	**+134**	**+26**

*Includes DOE, DOT, NASA, U.S.D.A., NSF, DARPA, Corp. of Engineers, FAA, and Commerce.

Page 138 in the National Energy Strategy.

Timeline for Commercial Introduction of Selected Energy Technologies



Advanced Geothermal
- Binary and other advanced geothermal

Waste Materials Management
- Municipal solid waste fluidized bed combustion
- Dual coating paint systems

Industrial Processes
- Advanced systems for combustion of black liquor and for drying paper in pulp and paper mills
- Advanced system for refining glass

Automotive Gas Turbine

Electric Vehicle With Advanced Batteries

Advanced Oil Recovery
- Chemical flooding, miscible flooding, thermal recovery, polymer flooding, profile modification and infill drilling

Clean Coal Technology
- Atmosphere fluidized bed
- Pressurized fluidized bed, combined cycle
- Integrated gasification combined cycle

Alternative Liquid Fuels From Biomass
- Enzymatic conversion
- Thermochemical conversion

Industrial Processes
- Advanced process for near-net shape casting of steel
- Advanced cell design for electrolytic production of aluminum

Buildings Technology
- Efficient, non-CFC refrigerants
- High efficiency lighting
- R-10$^+$ windows and electrochromic windows

Renewable Electric Technologies
- Advanced wind turbine technology
- Photovoltaics for distributed applications
- Biomass fluidized bed/high efficiency gas turbines

Nuclear Technology
- Advanced light water reactor

Advanced Diesel Engine

Fuel Cells
- Automotive applications
- Utility applications

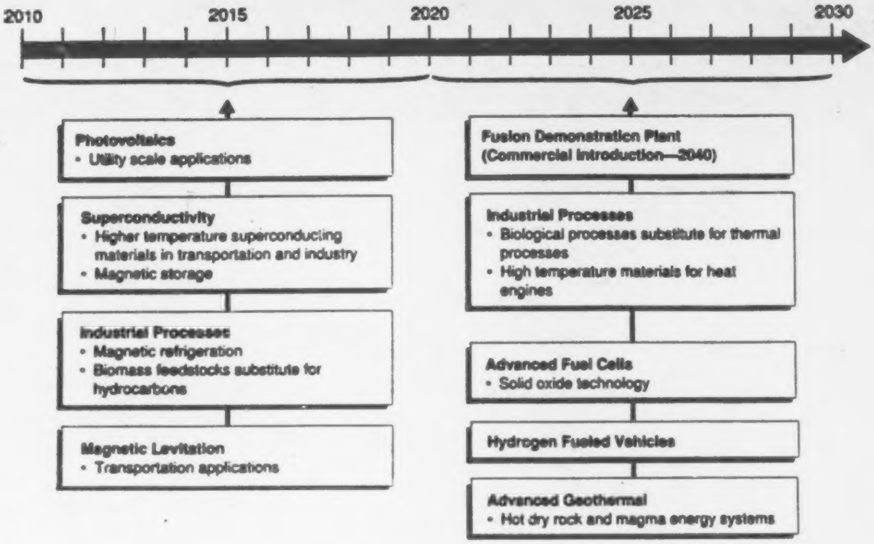
Nuclear Technology
- Modular high temperature gas reactor (MHTGR)
- Liquid metal reactor

Electric Storage Technologies
- Advanced batteries

Industrial Processes
- Advanced direct steelmaking

Clean Coal Technology
- Advanced pressurized fluidized bed
- Advanced integrated gasification combined cycle

Timeline for Commercial Introduction of Selected Energy Technologies


2010
2015
2020
2025
2030
Photovoltaics
• Utility scale applications
Superconductivity
• Higher temperature superconducting materials in transportation and industry
• Magnetic storage
Industrial Processes
• Magnetic refrigeration
• Biomass feedstocks substitute for hydrocarbons
Magnetic Levitation
• Transportation applications
Fusion Demonstration Plant (Commercial Introduction—2040)
Industrial Processes
• Biological processes substitute for thermal processes
• High temperature materials for heat engines
Advanced Fuel Cells
• Solid oxide technology
Hydrogen Fueled Vehicles
Advanced Geothermal
• Hot dry rock and magma energy systems

Department of Energy
Washington, DC 20585
April 26, 1991

The Honorable George E. Brown
Chairman
Committee on Science, Space, and Technology
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

Enclosed is the edited transcript of testimony given before your committee by James D. Watkins, Secretary of Energy on February 26, 1991, regarding the National Energy Strategy.

During the course of the hearing, Congressmen Zimmer and Wolpe requested certain information which was to be provided for the record. The information requested follows pages 51 and 78 of the transcript.

If we can be of further assistance to you or your staff, please contact our congressional hearing coordinator Barbara Barnes on (202) 586-6341.

Sincerely,

Jacqueline Knox Brown
Assistant Secretary
Congressional and Intergovernmental
Affairs

Enclosures

Committee: Science, Space and Technology
Subcommittee: NA
Date: February 26, 1991
Witness: Admiral Watkins
Page and Line: Page 51, Line 1180

Hydrogen Research and Development Plan

In accordance with P.L. 101-566 (Matsunaga Hydrogen Research, Development and Demonstration Act), the Department, through its Office of Conservation and Renewable Energy, is preparing a comprehensive multi-year program plan for a vigorous hydrogen research and development program. The plan, expected to be completed in August 1991, will include the proposed research tasks to develop the technologies for competitive hydrogen systems for the Nation's energy sectors.

Committee: Science, Space and Technology
Subcommittee: NA
Date: February 26, 1991
Witness: Admiral Watkins
Page and Line: Page 78, Line 1837

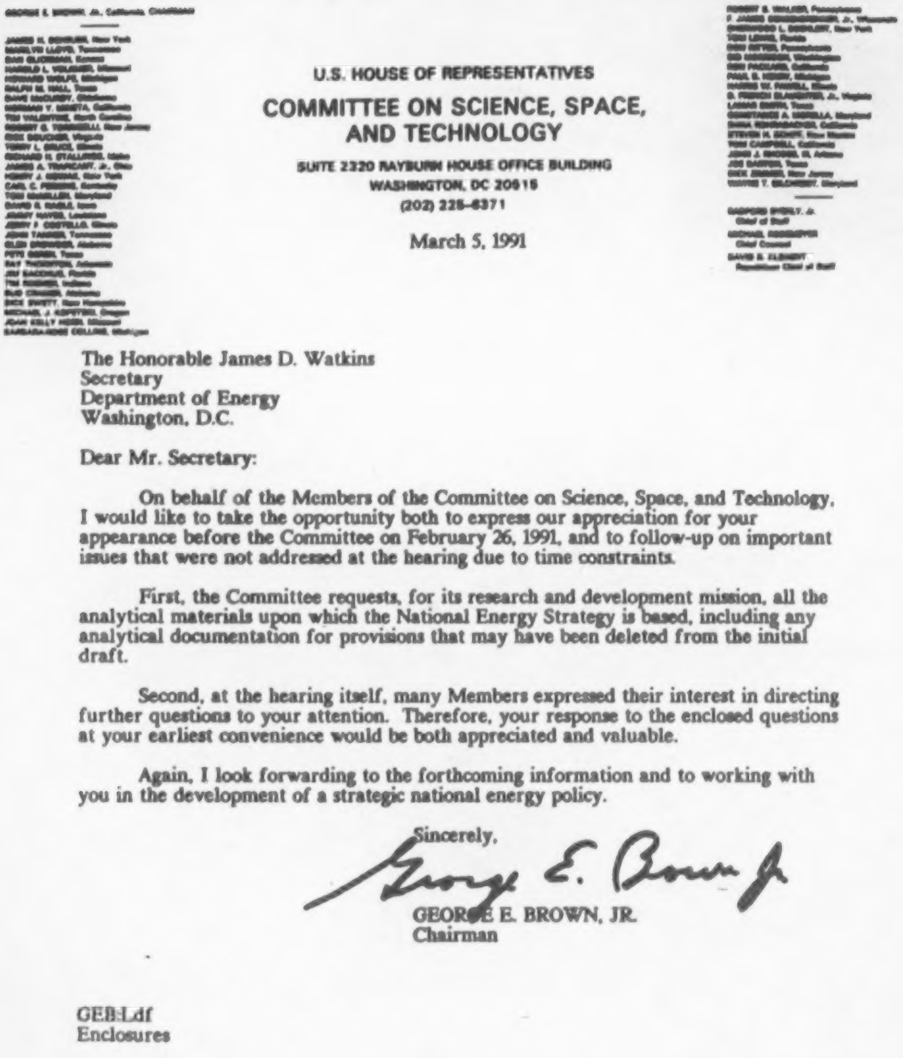
Photovoltaics for Generating Electricity

The growth of photovoltaics (PV) as an energy supply option is directly tied to the cost of electricity from PV power systems. We already know that PV systems perform very well, and they are being commercialized in a myriad of small, stand alone applications. However, PV electricity today costs about 25 cents to 40 cents per kilowatt hour, compared to baseload generating costs under 6 cents per kilowatt hour for conventional technologies. Clearly, these costs must be lowered substantially in order for PV to compete in utility power markets, and that requires continued progress on a number of fronts. We have already seen major progress in improving the technology at the laboratory scale, and one challenge is to transfer those research results into manufactured products. This is one objective of the Department's photovoltaics initiative announced last January. This initiative, called PVMaT (for Photovoltaics Manufacturing Technology), will directly support industry in developing advanced manufacturing technology which incorporates the latest laboratory research results. Our budget plans for this initiative are $9 million in FY 1991 with a total of about $50 million over the next several years, and we expect that these funds will be matched by industrial cost-sharing of the efforts. Moreover, industry is likely to follow these manufacturing technology development efforts with commitments for much larger outlays for construction of new PV manufacturing facilities. The success of this initiative will provide a major cost reduction for PV power and will enable PV to begin to compete for specialized utility loads including some peak power and distributed grid support applications.

Truly large-scale commercialization of PV will require even lower costs, and realizing these will require additional technological advances. For that reason our National Energy Strategy calls for an increase in our ongoing photovoltaics research and development program. As you know, the PV Program appropriated budget increased from $34 million in FY 1990 to $46 million in FY 1991, including funding for PVMaT, and we have requested another increase, to $50 million, for next fiscal year. As additional technology improvements become available through our R&D program, we will continue to support industry in their adoption. At the same time, the Department is also working with utilities and photovoltaic manufacturers to continue the evaluation of new PV power systems and to stimulate the incorporation of photovoltaics into utility-scale applications. With the continued progress of these programs, which have been very successful in the past, we believe that large-scale commercialization of photovoltaics will begin early in the next century. In all, we believe that we are on the right path to expeditiously commercialize PV power technology.

APPENDIX III

QUESTIONS AND ANSWERS FOR THE RECORD



U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE,
AND TECHNOLOGY
SUITE 2320 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
(202) 225-6371

March 5, 1991

The Honorable James D. Watkins
Secretary
Department of Energy
Washington, D.C.

Dear Mr. Secretary:

On behalf of the Members of the Committee on Science, Space, and Technology, I would like to take the opportunity both to express our appreciation for your appearance before the Committee on February 26, 1991, and to follow-up on important issues that were not addressed at the hearing due to time constraints.

First, the Committee requests, for its research and development mission, all the analytical materials upon which the National Energy Strategy is based, including any analytical documentation for provisions that may have been deleted from the initial draft.

Second, at the hearing itself, many Members expressed their interest in directing further questions to your attention. Therefore, your response to the enclosed questions at your earliest convenience would be both appreciated and valuable.

Again, I look forwarding to the forthcoming information and to working with you in the development of a strategic national energy policy.

Sincerely,

George E. Brown Jr.

GEORGE E. BROWN, JR.
Chairman

GEB:Ldf
Enclosures

NATIONAL ENERGY STRATEGY
RE: TECHNOLOGY TRANSFER
QUESTIONS FOR ADMIRAL WATKINS
FULL SST COMMITTEE HEARING
2/26/91

Constance Morella

1. ADMIRAL, I WISH TO DISCUSS WITH YOU THE AREA OF TECHNOLOGY TRANSFER. THE PRESIDENT'S NATIONAL ENERGY POLICY CONTAINS RECOMMENDATIONS TO INCREASE THE USE OF JOINT INDUSTRY-GOVERNMENT EFFORTS IN R&D AND IN THE COMMERCIALIZATION OF NEW TECHNOLOGIES. ONE OF THESE RECOMMENDATIONS IS TO PROVIDE COPYRIGHT PROTECTION FOR TECHNICAL DATA AND SOFTWARE. HOWEVER, BECAUSE COPYRIGHT PROTECTION IS NOT CURRENTLY AVAILABLE FOR ANY WORKS OF THE GOVERNMENT, FEDERAL EMPLOYEES ARE PROHIBITED FROM OBTAINING COPYRIGHT PROTECTION FOR WORKS CREATED IN THE COURSE OF THEIR OFFICIAL DUTIES.

BUT FOR GOVERNMENT-OWNED BUT CONTRACTOR-OPERATED LABORATORIES, SUCH AS OAK RIDGE AND LAWRENCE LIVERMORE, THE DEPARTMENT PERMITS CONTRACTORS TO COPYRIGHT TECHNICAL DATA AND COMPUTER SOFTWARE FOR COMMERCIAL PURPOSES. THEY ARE NOT SUBJECT TO THIS PROHIBITION. THE DEPARTMENT'S EXPERIENCE HAS REVEALED THAT PROPRIETARY RIGHTS CAN BE A SPUR TO THE COMMERCIALIZATION OF SOFTWARE DEVELOPED IN CONNECTION WITH FEDERAL PROGRAMS.

IN RELATION TO TECHNOLOGY TRANSFER, COULD YOU DISCUSS THE SUCCESS OF DEPARTMENT LABORATORIES IN COPYRIGHTING SOFTWARE AND SHARE YOUR VIEWS ABOUT APPLYING SUCH PROTECTION FOR OTHER JOINT INDUSTRY-GOVERNMENT EFFORTS?

2. I UNDERSTAND THAT OAK RIDGE IS WORKING WITH A COMPUTER SOFTWARE CONSORTIUM COMPOSED OF TWELVE COMPANIES. THE CONSORTIUM IS CO-FUNDING THE DEVELOPMENT OF USER-FRIENDLY AND INTELLIGENT SYSTEMS FOR MORE EASILY ACCESSING HIGHLY COMPLEX ANALYSIS MODELS. SIMILAR OPPORTUNITIES EXIST AT GOVERNMENT-OWNED AND OPERATED LABORATORIES, YET WE ARE UNABLE TO TAKE ADVANTAGE OF THESE OPPORTUNITIES, BECAUSE THE

GOVERNMENT CANNOT PROTECT SOFTWARE. WOULD YOU AGREE THAT WITHOUT AN APPROPRIATE POLICY DEALING WITH THE COMMERCIALIZATION OF FEDERALLY DEVELOPED SOFTWARE, THE PROSPECTS FOR ITS DEVELOPMENT AND COMMERCIALIZATION ARE LIMITED?

3. THE PRESIDENT HAS RECOGNIZED THAT COPYRIGHT PROTECTION FOR COMPUTER SOFTWARE CAN BE IMPORTANT TO COMMERICIALIZATION. THE NATIONAL ENERGY STRATEGY PROMOTES THE INCREASED USE OF PATENTS AND COPYRIGHTS, FOR FEDERALLY FUNDED RESEARCHERS TO PROTECT COMMERICALLY VALUABLE PROPERTIES. IT ALSO SUPPORTS ALLOWING FEDERAL AGENCIES TO SECURE COPYRIGHTS FOR COMPUTER SOFTWARE DEVELOPED UNDER CERTAIN COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS. I HAVE INTRODUCED A BILL, H.R. 191, WHICH WOULD DO JUST THAT. IN TERMS OF OUR NATION'S INTERNATIONAL COMPETITVENESS AND ABILITY TO SELF-DETERMINE OUR ENERGY FUTURE, WHAT ROLE DO YOU ENVISION FEDERAL TECHNOLOGY TRANSFER PLAYING?

QUESTIONS FOR THE RECORD
NATIONAL ENERGY STRATEGY HEARING
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
THE HONORABLE TERRY L. BRUCE, M.C.
February 26, 1991

WITNESS: ADMIRAL JAMES WATKINS, SECRETARY
DEPARTMENT OF ENERGY

1. THE DEPARTMENT OF ENERGY CONTENDS THAT ONE OF ITS MAIN GOALS IN ITS NATIONAL ENERGY STRATEGY IS FORTIFYING ITS FOUNDATIONS IN THE RESEARCH COMMUNITY. UNDER THAT GOAL, IS THE GOAL OF MAINTAINING USER FACILITIES, WHICH INCLUDE UNIVERSITY RESEARCH FACILITIES. HOWEVER, IN THE PRESIDENT'S BUDGET REQUEST, THE ACADEMIC FACILITIES MODERNIZATION PROGRAM HAS BEEN DELETED FOR THE COMING YEAR. HOW DO YOU EXPLAIN THIS DIFFERENCE IN WHAT THIS STRATEGY MAINTAINS AS A GOAL AND WHAT THE PRESIDENT HAS OBVIOUSLY PROVEN IS NOT A PRIORITY IN THIS YEAR'S BUDGET PROPOSAL?

2. MR. SECRETARY, HOW SHOULD WE AS A COUNTRY SHOULD PAY FOR RESEARCH AND DEVELOPMENT OF ALTERNATIVE FUELS? (ESPECIALLY SOLAR, WIND, ETHANOL, ETC.) WOULD YOU SUGGEST A COMBINATION OF PRIVATE AND PUBLIC FUNDING OF SUCH PROJECTS, AND IF SO, HOW WOULD YOU GO ABOUT "COLLECTING" OR MANDATING SUCH PRIVATE FUNDING?

Rep. Ralph M. Hall
Questions for Hon. James Watkins
Secretary of Energy

Secretary Watkins:

In the NES, you propose to open the Arctic National Wildlife Refuge (ANWR) and certain Outer Continental Shelf (OCS) areas for oil exploration and production. While I agree with your argument that these steps are needed in order to reduce our dependence of foreign oil, it could be years before we actually see any product coming from those areas. How long would you expect it would take to develop oil production in the ANWR and the OCS? Shouldn't we be looking at ways to improve oil and gas production in the lower 48 states during the interim?

In looking at your proposals, I see a number of things that would be beneficial to the major oil companies, but I see little that would help the nation's independent producers, such as a floor on oil prices or tax incentives for oil exploration. What kinds of things should Congress be doing to assist the independent producers who are so important to our national energy industry?

HARRIS W. FAWELL
13TH DISTRICT, ILLINOIS

EDUCATION AND LABOR
SUBCOMMITTEES:
LABOR-MANAGEMENT RELATIONS
ELEMENTARY, SECONDARY, AND
VOCATIONAL EDUCATION
LABOR STANDARDS

SCIENCE, SPACE, AND
TECHNOLOGY
SUBCOMMITTEES:
ENERGY RESEARCH AND DEVELOPMENT
INTERNATIONAL SCIENTIFIC COOPERATION

SELECT COMMITTEE ON AGING

Congreſs of the United States
House of Representatives
Washington, DC 20515

WASHINGTON OFFICE
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SUITE [illegible]
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February 26, 1991

Question for Secretary Watkins for submission into the record
Committee on Science, Space, and Technology

I am pleased that the National Energy Strategy shows a firm commitment to research and development on advanced nuclear systems, particularly the advanced liquid metal reactor (ALMR) program. As you know, the Integral Fast Reactor (IFR) has been designated as the centerpiece of the Department of Energy's Advanced Reactor program. What role do you see for the IFR in meeting our nuclear energy needs of the future, especially in view of its capability of recycling its wastes?

Harris W. Fawell, M.C.

THE HONORABLE ROBERT S. WALKER

QUESTIONS

HEARING ON THE NATIONAL ENERGY STRATEGY

FEBRUARY 26, 1991

1. ONE DISAPPOINTMENT IN THE ENERGY STRATEGY IS HYDROGEN. EVEN THOUGH P.L. 101-218 (THE RENEWABLE AUTHORIZATION ACT) AND P.L. 101-566 (THE HYDROGEN ACT) PROVIDE $8 MILLION FOR HYDROGEN ENERGY SYSTEMS R&D IN 1992, THE BUDGET ONLY INCLUDES $2.6 MILLION. GIVEN THAT HYDROGEN HAS A LIMITLESS SOURCE IN WATER AND IS CLEAN BURNING IN THAT IT COMBUSTS TO WATER, WHY ISN'T IT BEING FULLY PURSUED AS A LONG-RANGE ENERGY SOLUTION? AFTER ALL, ANOTHER LONG-RANGE POTENTIAL SOURCE, FUSION, IS SUPPORTED AT $300 MILLION A YEAR.

2. P.L. 101-218 (THE RENEWABLE ACT) AUTHORIZES HYDROGEN R&D AS A SEPARATE "RENEWABLE ENERGY RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAM." IT FURTHER MANDATES, NOT JUST REQUESTS, THAT THIS "HYDROGEN ENERGY SYSTEMS PROGRAM" BE SUBMITTED TO CONGRESS IN THE PRESIDENT'S BUDGET AS A "SEPARATE LINE ITEM." WHY THEN, FOR THE SECOND YEAR IN A ROW, DOES DOE DEFY THIS STATUTORY REQUIREMENT? (IN 1992, HYDROGEN RESEARCH IS MOVED FROM THE BIOFUELS ENERGY SYSTEMS PROGRAM AND IS SUBSUMED BY THE ENERGY STORAGE SYSTEMS PROGRAM.)

THE HONORABLE JOAN KELLY HORN
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HEARING ON THE NATIONAL ENERGY STRATEGY
FEBRUARY 26, 1991
QUESTIONS FOR THE HONORABLE JAMES WATKINS

1. The NES has been heavily criticized for its deficiencies in the area of conservation. This is especially true in transportation which account for more than 60% of our country's energy use. What is the reasoning behind the lack of initiatives in this area? Do you see the possibility of the addition of measures to promote transportation conservation? Possibly a gas guzzler tax or a gas sipper credit and higher CAFE standards that are known to save millions of barrels of oil?

2. The government is the largest user and abuser of our energy resources. Would the Department be in favor of possible federal procurement reforms that encourage the purchase of fuel efficient products and allowing federal agencies to retain savings from investing in energy efficiency?

TIM VALENTINE
SECOND DISTRICT
NORTH CAROLINA

PUBLIC WORKS AND
TRANSPORTATION COMMITTEE
SUBCOMMITTEES:
SURFACE TRANSPORTATION
AVIATION

SCIENCE, SPACE,
AND TECHNOLOGY COMMITTEE
SUBCOMMITTEES:
NATURAL RESOURCES, AGRICULTURE
RESEARCH AND ENVIRONMENT
ENERGY RESEARCH AND DEVELOPMENT
CHAIRMAN
SCIENCE, RESEARCH AND
TECHNOLOGY

Congress of the United States
House of Representatives
Washington, DC 20515

WASHINGTON OFFICE
[illegible]
ADMINISTRATIVE ASSISTANT
[illegible] LONGWORTH HOUSE OFFICE BUILDING
WASHINGTON, DC [illegible]
TELEPHONE [illegible]

DISTRICT OFFICE
[illegible]
DISTRICT ADMINISTRATIVE ASSISTANT
[illegible]
TELEPHONE [illegible]

[illegible]
TELEPHONE [illegible]

March 4, 1991

National Energy Strategy
Questions Submitted by Representative Tim Valentine
for
The Honorable James Watkins, Secretary of Energy
Science, Space, and Technology Committee Hearing
February 26, 1991

1. Last summer President Bush excluded North Carolina from his proposed ten year moratorium on the sale of new oil and gas drilling leases on the Outer Continental Shelf. This exclusion remains despite repeated requests from the North Carolina Congressional Delegation and Governor James Martin to include North Carolina in the moratorium. Is North Carolina, with its Wildlife Refuges, National Seashores, and beautiful Outer Banks, less deserving of protection than Massachusetts or Maine? How do you justify the continuing reliance of the Administration on the possibility of oil and gas production in this environmentally sensitive area?

2. What projected environmental impact do you foresee from the development of oil and gas drilling on the Outer Continental Shelf off the North Carolina coast? Has the possibility of environmental damage been considered in the development of the National Energy Strategy and other Administration plans to promote offshore oil and gas production in North Carolina?

3. The National Energy Strategy seems to rely on future development of national domestic offshore oil drilling to decrease our reliance on imported oil. Has the Department of Energy developed estimates of the average daily production of oil and gas in North Carolina if oil and gas production were to begin on the Outer Continental Shelf?

NATIONAL ENERGY STRATEGY HEARING
FEBRUARY 26, 1991
HONORABLE TIM ROEMER (D-IN)

QUESTIONS FOR SECRETARY OF ENERGY WATKINS

- I am informed that the Administrations alternative fuels policy centers around a program in which you propose to encourage the use of alternative fuels for centrally fueled fleets of vehicles. Early on in the formulation of the budget, I understand that DOE had proposed a "blends" program in which there would be a requirement for the nation's gasoline to be made up of some percentage of non-petroleum based products such as ethanol. This approach appears to have been abandoned for the proposed fleet program which may actually push fleet users toward natural gas usage, rather than other alternative fuels such as ethanol. Some argue that this approach only changes our policy emphasis from using imported oil to using imported natural gas. Could you please comment?

    - What happened to the "blends" program that had been proposed earlier in the budget process by DOE?

    - Shouldn't the increased use of blended fuels be a part of our national energy strategy?

- The Administration's budget request increases the funding for R&D on renewable fuels for the first time in several years. I would like to commend the Administration for this increase in an area that has been neglected. However, the increases requested still do not approach the amount of funding requested for such areas as magnetic fusion or nuclear power.

    - How can the Administration justify more money for technologies such as fusion, which clearly will not be ready for practical applications until the year 2000 or beyond, when renewables are here today and could have immediate applications?

- Mr. Secretary, the Department has noted that there is some good R&D going on in the area of deriving liquid fuels from biomass (e.g., using a broader range of plant matter, wood byproducts, etc., to manufacture fuels). Could you please comment on this research and provide your assessment of whether biomass techniques could be used to produce alternative fuels such as ethanol?

- Mr. Secretary, there appears to be precious little in the President's energy strategy that provides financial incentives for companies to invest in alternative fuels, except for some R&D incentives and some proposed deregulation for the hydroelectric power industry. The only financial incentive appears to be a 10% tax credit for solar and geothermal, both of which may not produce nearly the potential of solar or biomass applications., Why are there no incentives for producers of alternative fuels given that the budget reconciliation act last year contained big tax credits for oil and gas production enhancement?

- You mentioned the breakaway from useage to technology in renewable energy sources after the year 2010. isn't there some way to expedite this breakaway? Very specifically, what technologies are we talking about? Please give me some examples.

- Could you also be more specific on where we are now in magnetic levitation technology and photovoltaics - and how we are in comparison to our international competitors on this timeline (ie., Japan and Germany on mag-lev train technology).

- Secretary Watkins, you chair the Committee on Education and Human Resources to promote young students to get involved in math and science. I would like you to visit a school in my district and motivate and encourage this vital goal.

MEMORANDUM

QUESTIONS FROM CONGRESSMAN GEREN TO SECRETARY WATKINS SCIENCE, SPACE AND TECHNOLOGY COMMITTEE HEARING

1) I applaud you and the President on an impressive document explaining the choices available to us for developing a meaningful energy policy to fully exploiting our nation's cleanest, cheapest, and most abundant energy resources. In particular, the NES highlights the tremendous value of developing technology to efficiently extract our considerable natural gas resources. Having said that, I'd like to ask you to discuss these specific measures needed to fully exploit our natural gas resources.

a.) As you know, The 1990 appropriations by Congress for natural gas-related R&D was $123 million. The Department of Energy has asked for $73 million in FY 92. The gas industry is recommending a 10-year R&D initiative over 10 years, including $215 million in FY 92.

Natural gas consumption makes up 24% our national energy consumption. It has tremendous potential to reduce hazardous air emissions and increase energy efficiency. What percenttage of R&D should be devoted to natural gas? If you believe that only a low percentage of Energy R&D should be devoted to natural gas, why?

b. In some quarters, there are misconceptions about the levels of supply of natural gas, in part because of regulatory practices which limited extraction and development of natural gas in the 1970s. One such regulatory practice consisted of price controls sustaining artificially low prices for natural gas. Now that the gas industry has largely been deregulated, what is your assessment of claims of an insuffcient domestic supply of natural gas under the ground? How do you asess assertions that there are insufficient numbers of investors willing to drill in natural gas-prone fields?

c.)Current technology allows oil producers access to, at most, 30% of the natural gas in underground resevoirs. Enhanced oil recovery techniques could--eventually--significantly increase the % of gas which could be extracted, thereby greatly increasing the energy yield of drilling a single oil well. In your opinion, how much of a priority should R&D for enhanced oil recovery techniques be?

d.) A fuel cell utilizing natural gas is signficantly more efficient than electrically generated power and produces no hazardous air emissions. DOE's development of early model fuel cells, but cooperative projects to transfer this technology to facilitate its commericaliazation are limited. Moreover, there is a need for R&D for advanced fuel cells. Appropriations for R&D for fuel cells in FY 91 was $36 million. DOE is requesting $22 million this year. Why?

Department of Energy
Washington, DC 20585

April 17, 1991

The Honorable George E. Brown, Jr.
Chairman
Committee on Science, Space and Technology
U.S. House of Representatives
Washington DC 20515

Dear Mr. Chairman:

On February 26, 1991, James D. Watkins, Secretary of Energy, testified before your committee on the National Energy Strategy.

Following the hearing, you submitted written questions to follow-up on important issues that were not addressed at the hearing. These questions were submitted on behalf of yourself and Representatives Roemer, Morella, Bruce, Hall, Fawell, Walker, Horn, Valentine and Geren.

Enclosed are the answers to Questions 2 and 7 (Roemer); Question 1 (Morella); Questions 1 and 2 (Bruce); Question 1 (Fawell); Questions 2 and 3 (Valentine) and Questions 1(b), 1(c) and 1(d) (Geren). The remaining answers are in the clearing process and will be forwarded to you as expeditiously as possible.

If we can be of further assistance to you or your staff, please contact our Congressional Hearing Coordinator, Barbara Barnes, on (202) 586-6341.

Sincerely,

Jacqueline Knox Brown
Assistant Secretary
Congressional and Intergovernmental
Affairs

Enclosures

QUESTIONS FROM REPRESENTATIVE ROEMER

Question 2: The Administration's budget request increases the funding for R&D on renewable fuels for the first time in several years. I would like to commend the Administration for this increase in an area that has been neglected. However, the increases requested still do not approach the amount of funding requested for such areas as magnetic fusion or nuclear power. How can the Administration justify more money for technologies such as fusion, which clearly will not be ready for practical applications until the year 2000 or beyond, when renewables are here today and could have immediate applications?

Answer: There are many promising renewable energy technologies that will be making an ever increasing contribution to our Nation's mix of energy sources. You have observed that several renewable energy technologies are mature enough for practical applications. That implies that they have proven themselves in the laboratory and are now ready to compete in the market place. In fact, we are seeing an increased financial commitment from the private sector to develop and commercialize these technologies. As industry contribution increases, there is less need for the Federal government to "carry" the development. The government's role in developing some of these technologies is coming to an end. The commercialization of new technologies has historically been the role of the private sector. It would be inappropriate for the federal government to compete with the private sector in this commercialization process.

In contrast, fusion energy is just now making the transition from a research program to an energy development program. The fusion energy program has made great technical progress as a result of government supported research, but there is still a great deal to do before we can expect the private sector to begin to share the costs of fusion.

The Administration has given fusion energy a prominent position in the National Energy Strategy and supports it at the Fiscal Year 1992 funding levels that you have before you, because of its great promise. When developed, fusion energy could supply essentially unlimited energy from secure fuel sources with many intrinsic safety and environmental advantages over the use of fossil fuels or fission for the generation of base load electricity.

Question from Tim Roemer (D-IN)

Question 7.	Secretary Watkins, you chair the Committee on Education and Human Resources to promote young students to get involved in math and science. I would like you to visit a school in my district and motivate and encourage this vital goal.
Answer:	I appreciate this invitation, and look forward to an opportunity that would make such a visit possible. My staff will be in contact with yours to arrange a staff visit in the near future.

QUESTIONS FROM CONGRESSWOMAN MORELLA

Question 1: Admiral, I wish to discuss with you the area of technology transfer. The President's National Energy Policy contains recommendations to increase the use of joint industry-government efforts in R&D and in the commercialization of new technologies. One of these recommendations is to provide copyright protection for technical data and software. However, because copyright protection is not currently available for any works of the government, federal employees are prohibited from obtaining copyright protection for works created in the course of their official duties.

But for government-owned but contractor-operated laboratories, such as Oak Ridge and Lawrence Livermore, the Department permits contractors to copyright technical data and computer software for commercial purposes. They are not subject to this prohibition. The Department's experience has revealed that proprietary rights can be a spur to the commercialization of software developed in connection with federal programs.

In relation to technology transfer, could you discuss the success of Department laboratories in copyrighting software and share your views about applying such protection for other joint industry-government efforts?

Answer: Although it is not always necessary to do so, it is often easier to transfer technology for commercialization if all the pieces of the technology are protected through patents, copyrights, or other forms of protection. Under DOE's policy, DOE's contractor-operated laboratories can copyright software. There are also provisions for copyrighting training materials or other writings. These materials are often marketable and costly to prepare. Likewise, there are provisions for copyrighting or otherwise protecting engineering drawings or compilations of data.

There have been several success stories among the DOE laboratories in copyrighting and licensing software. For example, DOE's Sandia and Los Alamos National Laboratories have been very active in copyrighting software, as have Lawrence Livermore and Battelle's Pacific Northwest Laboratory. The following programs became commercially available within the last year, many within the last 6 months.

SolarTrak - allows solar arrays to follow the sun for maximum efficiency. In less than one year, 3 licenses have been granted to small businesses and many other inquiries have been received. (Sandia)

PAVING - simulates surfaces in quadrilateral patterns. Licenses negotiations are nearly complete for 6 licenses and many more are expected. (Sandia)

MITRO - recognizes and models topological patterns (shape, holes). Negotiations are in progress with 20 companies. (Sandia)

RIPE/RIPL - is a programming language for complex robotic systems. Interest is growing so quickly that it is not possible to quantify it. (Sandia)

HIPPI - tests for compliance of components for supercomputers and communications equipment. In the first month, more than 18 units were licensed. (Los Alamos)

You also asked whether I think such protection should be extended to other joint industry-government efforts. Although DOE would not recommend copyrighting everything that might have some commercial value, we agree that government-operated laboratories should be given the flexibility to copyright when the circumstances warrant it.

QUESTIONS FROM REPRESENTATIVE BRUCE

Question 1: The Department of Energy contends that one of its main goals in its National Energy Strategy is fortifying its foundations in the research community. Under that goal, is the goal of maintaining user facilities, which include university research facilities. However, in the President's budget request, the academic facilities modernizations program has been deleted for the coming year. How do you explain this difference in what this strategy maintains as a goal and what the President has obviously proven is not a priority in this year's budget proposal?

Answer: The academic facilities modernization program is the responsibility of the National Science Foundation and we suggest that you contact them for specific information about the program. However, we believe the President's FY 1992 budget request is fully supportive of National Energy Strategy goals, especially those for basic research and mathematics and science education. In the area of scientific user facilities, the Department of Energy's budget proposal for FY 1992 includes funding for operating and upgrading current user facilities and for designing or building needed additional facilities. These facilities are advanced experimental facilities for research in support of the Department's mission and include accelerators for nuclear and high energy physics, research reactors and advanced light sources for basic energy sciences and for health and environmental research, computer centers for all DOE research programs, and other specialized facilities. The facilities are used by scientists and engineers from National Laboratories, universities, and private industry. Some of the user facilities are located on university campuses.

QUESTION FROM CONGRESSMAN BRUCE

Question 2: Mr. Secretary, how should we as a country pay for research and development of alternative fuels? (Especially solar, wind, ethanol, etc.) Would you suggest a combination of private and public funding of such projects, and if so, how would you go about "collecting" or mandating such private funding?

Answer: The Federal Government has a legitimate role in long-term, high-risk, but potentially high-payoff R&D for alternate fuels. As R&D progresses on such technologies (including solar, wind, ethanol, and other renewables), private sector interest and willingness to enter into cost-shared joint ventures increases. The Department strongly encourages these joint ventures, especially as risks become sufficiently reduced and market readiness is viewed as nearer-term. We believe this mechanism is preferable to mandates for allocation of private capital or other Federal intervention into the marketplace.

QUESTIONS FROM CONGRESSMAN FAWELL

Advanced Liquid Metal Reactor Program

Question : 1. I am pleased that the National Energy Strategy shows a firm commitment to research and development on advanced nuclear systems, particularly the advanced liquid metal reactor (ALMR) program. As you know, the Integral Fast Reactor (IFR) has been designated as the centerpiece of the Department of Energy's Advanced Reactor program. What role do you see for the IFR in meeting our nuclear energy needs of the future, especially in view of its capability of recycling its wastes?

Answer: The integral Fast Reactor (IFR) system consists of a metal fueled Advanced Liquid Metal Reactor (ALMR) and a closely coupled Fuel Cycle Facility for pyrometallurgical reprocessing and refabrication of the spent ALMR metal fuel. Further, liquid-metal reactors can be designed to consume long-lived radioactive elements (such as plutonium, neptunium, and americium) that are produced in current commercial reactors. Potentially, then, this type of reactor could make a contribution to reducing the future burden of radioactive waste. In 1991, the National Academy of Sciences will evaluate the technical and economic feasibility of ALMR technology. By 1995, this National Academy of Sciences study, studies sponsored by the Department of Energy, and continuing research and development will provide a sound technical basis for evaluating ALMR technology's possible contribution to the long-term radioactive waste management system.

Answer
(continued): This IFR system can be deployed, in the longer term, when low cost uranium resources are exhausted, to breed and then burn fissile material from depleted uranium. With breeding, 50 to 100 times more energy can be produced from uranium than can be obtained from operation of light water reactors (LWRs).

This system has the potential to be deployed in the nearer term (in concert with LWRs) to produce electricity at competitive prices. We have initiated studies to explore the potential benefits of this development. Actinide burnup technology does not eliminate the need for a geologic repository.

With development and deployment of the IFR system, in concert with continuing deployment of LWRs, it could play a major role in meeting our nuclear energy needs in an environmentally acceptable manner in both the nearer term and over the long term.

QUESTIONS FROM REPRESENTATIVE VALENTINE

Question 2: **What projected environmental impact do you foresee from the development of oil and gas drilling on the Outer Continenal Shelf off the North Carolina coast? Has the possibility of environmental damage been considered in the development of the National Energy Strategy and other Administration plans to promote offshore oil and gas production in North Carolina?**

Answer: The environmental assessment of potential natural gas and oil exploration off the coast of North Carolina has been extensive. In August 1990, the Minerals Management Service released to Governor James Martin a Final Environmental Report on Mobil Oil's proposal to drill an exploratory well approximately 39 miles off North Carolina. The three volume, 2,200 page report addressed concerns expressed by Governor Martin, the State's Outer Continental Shelf Office, special interest groups, and the public. The report concluded that the single exploratory well would have no significant environmental effects.

The Final Environmental Report also looked at the potential environmental effects of "downstream" development and production activities given a commercial discovery of natural gas offshore North Carolina. If Mobil Oil and its partners were to submit a development and production plan, the MMS is committed to preparing an Environmental Impact Statement on the proposal. This would allow the MMS to perform a more site-specific analysis of potential development effects than conducted in the Final Environmental Report.

Additional study is being conducted. Section 6003 of the 1990 Oil Pollution Act mandated the establishment of a five-person Environmental Sciences Review Panel (ESRP). The ESRP is directed to "assess the adequacy of available physical oceanographic, ecological, and socioeconomic information" for offshore North Carolina enabling the Secretary of the Interior to carry out his responsibilities under the OCS Lands Act with respect to certain decisions about energy development off the Outer Banks. The Secretary will consider the Panel's findings and recommendations in assessing any future OCS activities proposed for the area offshore North Carolina.

Both the National Energy Strategy and the OCS program developed by the Minerals Management Service explicitly established environmental safeguards for all proposed energy related activities, including any activities that might be proposed for areas off the coast of North Carolina. Energy related activities will only be permitted when those activities can be conducted in accordance with stringent standards of environmental protection.

QUESTIONS FROM REPRESENTATIVE VALENTINE

Question 3: The National Energy Strategy seems to rely on future development of national domestic offshore oil drilling to decrease our reliance on imported oil. Has the Department of Energy developed estimates of the average daily production of oil and gas in North Carolina if oil and gas production were to begin on the Outer Continental Shelf?

Answer: The area off North Carolina is thought to contain significant quantities of natural gas--up to 5 trillion cubic feet of natural gas in the area encompassed by the Manteo Prospect currently under lease. Significant oil resources are considered unlikely. Neither the Department of Energy nor the Department of the Interior has prepared estimates of average daily production of oil and gas in North Carolina if production were to begin on the Outer Continental Shelf. Such an estimation would be inappropriate and potentially misleading prior to the completion of exploratory activities to determine the existence of commercial natural gas deposits.

QUESTIONS FROM CONGRESSMAN GEREN

Natural Gas Supplies

Question 1b. In some quarters, there are misconceptions about the levels of supply of natural gas, in part because of regulatory practices which limited extraction and development of natural gas in the 1970s. One such regulatory practice consisted of price controls sustaining artificially low prices for natural gas. Now that the gas industry has largely been deregulated, what is your assessment of claims of an insufficient domestic supply of natural gas under the ground? How do you assess assertions that there are insufficient numbers of investors willing to drill in natural gas-prone fields?

Answer: We find no analytical basis for assertions that the domestic natural gas resource base is insufficient to meet projected demand for natural gas. In a 1988 study entitled An Assessment of the Natural Gas Resource Base of the United States, DOE estimated that the United States has at least 35 years' worth of natural gas supply at current consumption levels that could be produced for under $3.00 (in 1987 dollars) per thousand cubic feet. In addition to the existing abundant domestic resource base, other sources (such as additional recovery from improved technology, natural gas from Canada and liquified natural gas) ensure that gas resource availability will be more than adequate over the 40-year span covered by the National Energy Strategy. In order to continue to provide information that will assist the market in fully utilizing the potential for natural gas, DOE will conduct a second resource base study, to be completed in 1992, that will focus on longer term resources and on different technology assumptions.

As far as increased drilling activity is concerned, we believe that the key to future natural gas production is the removal of transportation bottlenecks that prevent natural gas from reaching ready markets. The NES proposes a wide range of gas pipeline regulatory reforms aimed at increasing capacity and enhancing consumption. Once these reforms are in place, we expect drilling activity to increase in response to higher demand.

QUESTIONS FROM CONGRESSMAN GEREN

Question: 1c. Current technology allows oil producers access to, at most, 30% of the natural gas in underground reservoirs. Enhanced oil recovery techniques could--eventually--significantly increase the percentage of gas which could be extracted, thereby greatly increasing the energy yield of drilling a single oil well. In your opinion, how much of a priority should R&D for enhanced oil recovery techniques be?

Answer: Research and development (R&D) for enhanced oil recovery technologies is a high NES and Fiscal Year 1992 budget priority. The Administration's FY92 budget request for advanced oil recovery research and development is $52 million, a 24 percent increase over the request for FY91. The overall approach of the R&D program is to focus on those types of oil deposits that have the greatest potential for improved oil recovery and the greatest risk of abandonment within the next 5 to 10 years.

Currently, conventional technology allows producers to recover, on the average, 35 percent of the oil in underground reservoirs. Oil reservoirs have associated gas which is recovered with the oil. The amount of gas recovered depends on the gas-to-oil ratio in the reservoir. Use of enhanced oil technologies will enable producers to recover more oil, and thus more associated gas, from reservoirs.

Conventional technology permits a larger percentage of the gas resource to be recovered from reservoirs containing only gas than is the case with oil. Depending on the presence of water bearing strata underneath a gas reservoir, between 50 and 90 percent of the gas can be recovered.

QUESTIONS FROM REPRESENTATIVE GEREN

Fuel Cells

Question 1.d: A fuel cell utilizing natural gas is significantly more efficient than electrically generated power and produces no hazardous air emissions. DOE's development of early model fuel cells, but cooperative projects to transfer this technology to facilitate its commercialization are limited. Moreover, there is a need for R&D for advanced fuel cells. Appropriations for R&D for fuel cells in FY 91 was $36 million. DOE is requesting $22 million this year. Why?

Answer: The FY 92 request of $22 million is to fund molten carbonate and solid oxide fuel cells development, whereas the FY 91 appropriation included funding for phosphoric acid fuel cells. The request also reflects overall fiscal constraints. Phosphoric acid fuel cells (PAFC) are being commercialized by the private sector. Therefore, no funding is requested in that area. A wrap up of PAFC "configuration B" improved technology development will be completed in FY 92 at IFC with previously obligated funds.

The molten carbonate system/stack scale-up would continue at two contractors at the FY 1991 level of effort by seeking increased cost sharing over that obtained in FY 1991. A small systems analysis task would be continued. Stack research by the third developer and electrode materials development would be discontinued.

Development of tubular solid oxide systems would be continued at FY 1991 levels by seeking increased cost sharing over that obtained in FY 1991. A small systems analysis task would be continued. Development of the monolithic solid oxide fuel cell and special materials for advanced concepts would be discontinued.

Department of Energy
Washington, DC 20585

April 18, 1991

The Honorable George E. Brown, Jr.
Chairman
Committee on Science, Space and Technology
U.S. House of Representatives
Washington DC 20515

Dear Mr. Chairman:

On February 26, 1991, James D. Watkins, Secretary of Energy, testified before your committee on the National Energy Strategy.

Following the hearing, you submitted written questions to follow-up on important issues that were not addressed at the hearing. These questions were submitted on behalf of yourself and Representatives Roemer, Morella, Bruce, Hall, Fawell, Walker, Horn, Valentine and Geren.

At the time of my last letter to you dated April 17, 1991, responses to several questions were still outstanding. Enclosed are the responses to questions 1, 1(a) and 3 (Roemer); question 2 and 3 (Morella); questions 1(a) and 1(b) (Hall); questions 1 and 2 (Walker); questions 1 and 2 (Horn); and question 1 (Valentine). The remaining answers are in the clearing process and will be forwarded to you as expeditiously as possible.

If we can be of further assistance to you or your staff, please contact our Congressional Hearing Coordinator, Barbara Barnes, on (202) 586-6341.

Sincerely,

Jacqueline Knox Brown
Assistant Secretary
Congressional and Intergovernmental
Affairs

Enclosures

QUESTIONS FROM CONGRESSMAN ROEMER

Question 1: **I am informed that the Administration's alternative fuels policy centers around a program in which you propose to encourage the use of alternative fuels for centrally fueled fleets of vehicles. Early on in the formulation of the budget, I understand that DOE had proposed a "blends" program in which there would be a requirement for the nation's gasoline to be made up of some percentage of non-petroleum based products such as ethanol. This approach appears to have been abandoned for the proposed fleet program which may actually push fleet users toward natural gas usage, rather than other alternative fuels such as ethanol. Some argue that this approach only changes our policy emphasis from using imported oil to using imported natural gas. Could you please comment?**

Answer: A number of options were considered in developing the NES. One of these was a requirement that a certain fraction of transportation fuels should be derived from non-petroleum sources. Refiners and other fuel providers could have met such a requirement through the use of non-petroleum components blended into gasoline (e.g., ethanol, ETBE, MTBE), non-petroleum feedstocks to the refinery (e.g., shale oil) or with alternative fuels (e.g., CNG, ethanol, methanol, propane, etc.). This proposal was not included in the final NES because of concern about its cost, feasibility and desirability.

The alternative fuel fleet vehicle proposal in the NES does not "push" fleet users toward any particular fuel. Vehicles capable of using alcohol fuels are less costly than vehicles capable of using compressed natural gas (CNG). The cost of operating and manufacturing CNG vehicles, however, appears to be lower than similar costs for alcohol vehicles. Moreover, different alternative fuels may be better suited to different types of vehicles. CNG technologies appear particularly well-suited to buses, trucks and vans, while light-duty passenger vehicle alcohol fuel technology appears to be more advanced.

In short, we believe that the state of vehicle technology and the relative retail prices of alternatives fuels will be the most important determinants of the vehicle and fuel choices made by manufacturers and fleet operators.

It should be noted that the alternative fuels proposals contained in the NES are not limited to the fleet program. The NES proposes an aggressive R&D program to develop alternative transportation fuels and technologies. A major initiative to develop biomass feedstocks and the technology to turn those feedstocks into economically-competitive transportation fuels is included in this program. The NES aims to displace large volumes of oil in transportation by the year 2010 with a variety of fuels and technologies that do not carry the security implications associated with increased dependence on oil.

QUESTIONS FROM CONGRESSMAN ROEMER

Question 1(a): What happened to the "blends" program that had been proposed earlier in the budget process by DOE?

Answer: The "blends" option was uneconomic and a command and control intervention into the fuels marketplace. It would have necessitated a massive, costly government regulatory system that would have been similar to the failed price, allocation, and entitlements program used during the 1970s.

Question 1(b): Shouldn't the increased use of blended fuels be a part of our national energy strategy?

Answer: We believe that the motor fuel industry will provide alternative fuels to vehicles that can use them without placing uneconomic, inefficient regulatory requirements on the motor fuel industry.

We expect that oxygenates will be fully used in gasoline without further government requirements because the Clean Air Act Amendments of 1990 (CAAA) are likely to result in the widespread use of reformulated gasoline. The CAAA reformulated gasoline "opt-in" provisions, combined with requirements for State Implementation Plans that will lead to ozone compliance, provide a strong incentive for many States to include their non-compliance urban areas in the reformulated gasoline program.

Consequently, we expect that the CAAA will result in 600-700 thousand barrels per day of oil displacement by use of oxygenates in gasoline by the year 2000.

QUESTIONS FROM CONGRESSMAN TIM ROEMER

BIOMASS FUELS

Question 3:	Mr. Secretary, the Department has noted that there is some good R&D going on in the area of deriving liquid fuels from biomass (e.g., using a broader range of plant matter, wood byproducts, etc., to manufacture fuels). Could you please comment on this research and provide your assessment of whether biomass techniques could be used to produce alternative fuels such as ethanol?
Answer:	Currently, some 850 million gallons per year of ethanol are produced by converting the starch in corn to sugar and fermenting the sugar to ethanol. This ethanol however is not economically competitive without federal and state subsidies. The major components in most plant matter are, however, cellulose and hemicellulose. These are more difficult to convert into ethanol. Research has improved the technology of converting cellulose into ethanol and recent results have shown methods of effectively converting the hemicellulose as well. That process has led to a 50 percent increase in the amount of ethanol that one can convert from a given amount of plant matter. Research is also producing significant results in increasing the growth rate and energy content of grasses and trees optimized for the production of ethanol. However, there are significant hurdles that must be overcome such as, competitiveness and potential variation in annual production because of the weather (e.g., droughts).

We are working with the Department of Agriculture to expand research in these fields. Such research could lead to increased products and income for the farm sector as well as an additional domestic fuel source. Waste paper and wood products waste can also be used as feedstocks and the use of the cellulose residue from corn could improve the economics of the corn ethanol process. This research has led to a decrease from $3.60 per gallon in 1980 to $1.27 today in the estimated cost of producing ethanol from a wide variety of cellulose materials. The current estimated cost is the energy equivalent of $1.88 per gallon of gasoline. Much additional research is needed, but our goal is to achieve the $0.60 per gallon necessary to be competitive with gasoline on an energy equivalent basis, without subsidies, by the end of the decade.

QUESTIONS FROM CONGRESSWOMAN MORELLA

Question 2: I understand that Oak Ridge is working with a computer software consortium composed of twelve companies. The consortium is co-funding the development of user-friendly and intelligent systems for more easily accessing highly complex analysis models. Similar opportunities exist at Government-owned and operated laboratories, yet we are unable to take advantage of these opportunities, because the Government cannot protect software. Would you agree that without an appropriate policy dealing with the commercialization of federally developed software, the prospects for its development and commercialization are limited?

Answer: We agree that without an appropriate policy dealing with commercialization of federally developed software, some opportunities to commercialize such technology may be lost. Copyright protection is one way to promote commercialization and we certainly support the provisions in your bill, H.R. 191, and the similar provisions in the Administration's proposed National Energy Strategy Act, that would allow federal agencies to secure copyrights for software developed under Cooperative Research and Development Agreements (CRADAs), but not the informational (i.e. database) component. We would expect agencies to take advantage of this authority except in special cases where there are benefits from placing the software in the public domain that outweigh federal technology commercialization objectives.

Federal agencies should have the authority to support commercialization objectives, such as through copyright protection. In some cases, the ability to withhold software from public dissemination until it has been commercialized, as authorized by the National Competitiveness Transfer Act of 1989 for Cooperative Research and Development Agreements, may be sufficient.

DOE is proud of the consortium of 12 companies that you mention. The work first began in the late 1970's. Oak Ridge National Laboratory placed a notice in the Commerce Business Daily and attracted 12 companies to form the Thermomechanical Modeling Software Development Center. Each company contributed $20,000 and DOE matched their contributions. The consortium contracted with Integrated Engineering Design in Houston for the development of software. The main goal has been the forming of an integrated engineering design technology for refractories -- the linings for must major industrial equipment as utility boilers, blast furnaces and steel-industry ladles.

Certainly, other laboratories could use this consortium as a model. While there are lessons here about copyright protection of software, the more important lessons are about public-private cooperation. Oak Ridge could not have developed software so useful to industry without industry participation, and the industry would not have this benefit without Oak Ridge's leadership and its financial and intellectual contributions.

QUESTIONS FROM CONGRESSWOMAN MORELLA

Question 3: The President has recognized that copyright protection for computer software can be important to commercialization. The National Energy Strategy promotes the increased use of patents and copyrights, for federally funded researchers to protect commercially valuable properties. It also supports allowing Federal agencies to secure copyrights for computer software developed under certain cooperative research and development agreements. I have introduced a bill, H.R. 191, which would do just that. In terms of our nation's international competitiveness and ability to self-determine our energy future, what role do you envision Federal technology transfer playing?

Answer: DOE fully supports the idea that the first copyrighting of government works will be done under Cooperative Research and Development Agreements (CRADAs). This will put government researchers in a role closer to that of their industry counterparts. We think this will lead to more harmonious cooperation between government and industry, particularly when the software is jointly developed.

As to your question about the role of federal technology transfer in our nation's international competitiveness and ability to self-determine our energy future -- we think it is a vital role. In fact, the area of competition with greatest impact on the U.S. and on the world is competition for energy resources. This competition determines the price and availability of energy, and this ultimately establishes the economic strength and national security of our Nation.

Through the development and commercialization of advanced energy-related technologies, the U.S. can improve the efficiency by which energy is used in homes, businesses, industry and transportation; reduce emissions and wastes from using this energy; lower the costs of energy service; and reduce our vulnerability to unstable sources of energy. Federal agencies and laboratories have an important role to play in this regard, since nearly half of all research and development (R&D) in the U.S. is funded by the Government.

Federal technology transfer can contribute to our energy future by supporting the development of innovative energy and environmental technologies and accelerating the introduction of these technologies into the marketplace. In addition, effective technology transfer can improve our overall economic performance by strengthening U.S. energy and environmental firms, generating new jobs, decreasing our trade deficits through the export of these new technologies, and thus enhance overall U.S. competitiveness.

QUESTIONS FROM CONGRESSMAN HALL

Question 1(a): In the NES, you propose to open the Arctic National Wildlife Refuge (ANWR) and certain Outer Continental Shelf (OCS) areas for oil exploration and production. While I agree with your argument that these steps are needed in order to reduce our dependence on foreign oil, it could be years before we actually see any production coming from these areas. How long would you expect it would take to develop oil production in the ANWR and the OCS? Shouldn't we be looking at ways to improve oil and gas production in the lower 48 states during the interim?

Answer: Based on the development histories of the North Slope oilfields, the Department of the Interior estimates that the ANWR schedule could be as long as 8 to 9 years from lease sale completion to production start-up. If the lease sale process itself is added to this schedule, production could start about 11 years from today.

The OCS production profile contained in the NES is based on projections made by the Minerals Management Service (MMS) of the Department of the Interior. In calculating the OCS oil production profile, the MMS assumes that the areas under the Congressional moratorium (the Mid-Atlantic, including North Carolina, the Eastern Gulf of Mexico north of 26°N latitude, and the North Aleutian Basin) will be removed from those moratoria and offered for lease sometime between 1992 and 1997.

Initial oil production from the currently restricted OCS areas, following these assumptions, should begin in the year 2001. Oil production from these areas should peak in the year 2018 at approximately 390,000 barrels per day. The estimated lapse of time between the year in which these areas are offered for lease and the year in which production begins is based on historical data regarding producer behavior.

During the interim, the NES, if followed, would result in increased domestic oil and gas production in the lower 48 States by supporting the development and use of enhanced oil recovery technologies. An estimated 300 billion barrels of oil in the lower 48 are unrecoverable using conventional methods. The objective of our enhanced oil recovery research program is to preserve access to existing producing reserves by delaying well abandonments and increasing reserves and production. Our gas research program will develop better, lower cost ways to produce gas from both conventional and unconventional resources.

QUESTIONS FROM CONGRESSMAN HALL

Question 1(b): In looking at your proposals, I see a number of things that would be beneficial to the major oil companies, but I see little that would help the nation's independent producers, such as a floor on oil prices or tax incentives for oil exploration. What kinds of things should Congress be doing to assist the independent producers who are so important to our national energy industry?

Answer: Congressional support will be essential for a number of NES initiatives aimed at increasing the economic viability of independent oil and gas producers.

The NES proposes an increase in R&D funding for development of advanced oil recovery technologies. The FY92 budget request for this program is $52 million, a 24 percent increase over the request for FY91. This R&D program will emphasize more near term R&D and technology transfer to increase participation by independent producers.

The NES natural gas regulatory reform package would substantially increase producer revenues by increasing natural gas demand and reducing transportation and distribution costs. It also will expedite pipeline construction to allow producers to get their product more quickly to market. Finally, the NES supports more rigorous analysis of the effects of regulation on energy production and facilities. DOE will lead an interagency task force in developing guidelines for preparing energy impact analyses to be considered in all major rulemakings and legislative proposals.

With regard to tax incentives for independents, a five year package of incentives worth $2.25 billion was approved by Congress last year in the 1990 budget reconciliation legislation. These incentives will encourage additional domestic exploration and development, and greater recovery of oil and gas from existing fields. A special energy alternative minimum tax deduction is provided for independents. Independents will also benefit from modifications of the percentage depletion rules that primarily will support marginal production.

The analysis conducted in support of the NES indicates that the imposition of an oil import fee or a price floor would produce net losses to the U.S. economy that would far outweigh the benefits of any additional domestic production resulting from these options.

QUESTION FROM REPRESENTATIVE WALKER

Question 1:	One disappointment in the energy strategy is hydrogen. Even though P. L. 101-218 (The Renewable Authorization Act) and P. L. 101-566 (The Hydrogen Act) provide $8 million for Hydrogen Energy Systems R&D in 1991, the budget only includes $2.6 million. Given that hydrogen has a limitless source in water and is clean burning in that it combusts to water, why isn't it being fully pursued as a long-range energy solution? After all, another long-range potential source, fusion, is supported at $300 million a year.
Answer:	Hydrogen is not a primary energy source, like fusion, but rather is an energy carrier, like electricity, that depends on the consumption of primary energy sources for its production. Current technologies for producing hydrogen are suitable for satisfying established niche markets, for example, in the chemical industry, but the resulting hydrogen product is not competitive in mass fuel markets. Therefore, the Department, through its Office of Conservation and Renewable Energy (CE), is responding to these public laws by preparing a comprehensive multi-year program plan for a vigorous hydrogen research and development program. The plan will include the proposed research tasks to develop the technologies for competitive hydrogen systems for the Nation's energy sectors. The Department believes that its FY 1991 request will provide all the funds necessary to perform the initial program tasks to identify potentially competitive hydrogen systems meriting emphasis in the coming years, and to continue advancing fuels-related research.

QUESTION FROM CONGRESSMAN WALKER

Question 2: P.L. 101-218 (The Renewable Act) authorizes Hydrogen R&D as a separate "renewable energy research, development and demonstration program." It further mandates, not just requests, that this "Hydrogen Energy Systems Program" be submitted to Congress in the President's Budget as a "separate line item." why then, for the second year in a row, does DOE defy this statutory requirement? (In 1992, hydrogen research is moved from the Biofuels energy Systems Program).

Answer: The FY 1992 Budget includes a separate line-item titled "Hydrogen Research" as a distinct element within the energy Storage Systems program (Volume 2, page 137, of the FY 1992 DOE Congressional Request). The FY 1991 Congressional request also included a separate line-item titled "Hydrogen Production Research" (Volume 2, page 47, of the FY 1991 DOE Congressional Budget Request). The Hydrogen program is not "subsumed" within the Energy Storage program. It is one of several important energy storage options. In fact, the FY 1992 budget supports an aggressive Hydrogen program, which focuses on efficient methods of production and storage that will allow hydrogen to evolve into a cost effective alternative for use in the future energy infrastructure. Constitutionally, The President has the sole responsibility and complete authority to propose a budget as he deems appropriate.

QUESTIONS FROM CONGRESSWOMAN JOAN KELLY HORN

Question 1: The NES has been heavily criticized for its deficiencies in the area of conservation. This is especially true in transportation, which accounts for more than 60% of our country's energy use. What is the reasoning behind the lack of initiatives in this area? Do you see the possibility of the addition of measures to promote transportation conservation? Possibly a gas guzzler tax or a gas sipper credit and higher CAFE standards that are known to save millions of barrels of oil?

Answer: We would note to begin with that transportation does not account for 60 percent of our country's energy use. Rather, it accounts for about 27 percent of U.S. energy consumption (22 quads out of 82). The 60 percent figure you cite is just U.S. petroleum consumption.

We believe that the criticism you cite is unfounded. The NES places heavy emphasis on conservation in all sectors, including transportation. Our focus is on overall system efficiency, long term efficiency gains through technology development and the introduction of alternative fuels. These measures have the greatest potential to significantly reduce transportation oil demand. CAFE standards, which are under further study by the Administration, and gas guzzler taxes/sipper credits tend to accelerate the utilization of available technology or shift vehicle size mix. They do little to support technology innovation or long term changes in the fuel mix. The NES focus on alternative fuels for the transportation sector reflects our goal of breaking the total reliance of this sector on oil, not just slowing the growth in oil use.

QUESTION FROM CONGRESSMAN HORN

Question 2: The government is the largest user and abuser of our energy resources. Would the Department be in favor of possible Federal procurement reforms that encourage the purchase of fuel efficient products and allowing Federal agencies to retain savings from investing in energy efficiency.

Answer: The Department and the Administration are in favor of Federal procurement policies that would encourage the purchase of life-cycle cost effective, energy efficient products in the Federal government. The President issued an Executive Order directing the purchase of energy efficient goods and products by requiring Federal agencies to produce products that are the most life-cycle cost effective. (See attached fact sheet.) We also generally support the idea of allowing agencies to retain a portion of the savings, net of energy efficiency investment costs, resulting from investments in energy efficiency, if the savings can be clearly identified.

Additionally, the Department has proposed legislation that allows agencies to participate in utility demand side management programs and to retain, and use, without further appropriations, the savings derived from participation in the programs.

FACT SHEET

EXECUTIVE ORDER

FEDERAL ENERGY MANAGEMENT

The President today signed an Executive Order on Federal Energy Management that directs all Federal agencies to improve the energy efficiency of their buildings and facilities by 20% from 1985 to 2000. The Executive Order is one of the first actions taken by the Administration to implement the recommendations of the National Energy Strategy.

The Administration is directed by the Federal Energy Management Improvement Act of 1988 to increase the energy efficiency of its buildings by 10% between 1985 and 1995. The Executive Order sets a higher goal of a 20% saving by 2000 and for the first time sets an energy-saving goal for Federal industrial facilities and transportation.

Specific provisions of the Executive Order include:

- A 20-percent improvement in energy efficiency per square foot in Federal buildings from 1985 to 2000,
- A 20-percent improvement in energy efficiency in industrial facilities from 1985 to 2000,
- A reduction in motor vehicle petroleum use of 10 percent by 1995 over 1991 levels, and
- A requirement that the maximum number of alternative fuel vehicles practicable will be acquired by the end of 1995, consistent with the Alternative Motor Fuels Act of 1988.

In addition, the Executive Order requires Federal agencies to procure energy efficient products, participate in utility demand-side management programs, and comply with performance requirements for new Federal buildings.

The Executive Order directs all Federal departments and agencies to take the actions necessary to achieve these goals.

The Federal Government is the nation's largest consumer of energy, consuming about 2 quadrillion Btu's in 1989 at a total cost of $8.7 billion. About half of this consumption is defense related--e.g., aviation fuel-- and would not be affected. The Executive Order is expected to save about $800 million by the year 2000.

QUESTIONS FROM REPRESENTATIVE VALENTINE

Offshore Oil and Gas Drilling

Question 1: Last summer President Bush excluded North Carolina from his proposed ten year moratorium on the sale of new oil and gas drilling leases on the Outer Continental Shelf. This exclusion remains despite repeated requests from the North Carolina Congressional Delegation and Governor James Martin to include North Carolina in the moratorium. Is North Carolina, with its Wildlife Refuges, National Seashores, and beautiful Outer Banks, less deserving of protection than Massachusetts or Maine? How do you justify the continuing reliance of the Administration on the possibility of oil and gas production in this environmentally sensitive area?

Answer: The President's decisions for the Outer Continental Shelf (OCS) should not lead to the conclusion that North Carolina is any less deserving of environmental protection than Maine or Massachusetts or any other state. The OCS natural gas and oil program administered by the Department of the Interior's Minerals Management Service (MMS) is tailored to the characteristics of each coastal area.

There are some important differences between the specific circumstances of the North Atlantic area compared to the Mid-Atlantic. These areas possess different characteristics in terms of the status and results of various environmental studies that have been or are being performed, the potential natural gas and oil resources present, the status of existing leases, the history of previous leasing, and the status and potential results of consultative efforts in these areas.

It should be noted that the Administration's decisions regarding the Mid-Atlantic area mean that leasing will be considered in the 1992-1997 period. However, an extensive review process still must conducted before a sale can be actually held and an Environmental Inpact Statement (EIS) prepared.

Department of Energy
Washington, DC 20585

April 26, 1991

The Honorable George E. Brown, Jr.
Chairman
Committee on Science, Space and Technology
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

On February 26, 1991, James D. Watkins, Secretary of Energy, testified before your committee on the National Energy Strategy.

Following the hearing, you submitted written questions to follow-up on important issues that were not addressed at the hearing. These questions were submitted on behalf of yourself and Representatives Roemer, Morella, Bruce, Hall, Fawell, Walker, Horn, Valentine and Geren.

At the time of my last letter to you dated April 18, 1991, responses to several questions were still outstanding. Enclosed are responses to questions 4-6 (Roemer). The remaining answers are in the clearing process and will be forwarded to you expeditiously as possible.

If we can be of further assistance to you or your staff, please contact our Congressional Hearing Coordinator, Barbara Barnes on (202) 586-6341.

Sincerely,

Elizabeth M Schaben for
Jacqueline Knox Brown
Assistant Secretary
Congressional and Intergovernmental
Affairs

Enclosure

QUESTIONS FROM CONGRESSMAN ROEMER

Question 4: Mr. Secretary, there appears to be precious little in the President's energy strategy that provides financial incentives for companies to invest in alternative fuels, except for some R&D incentives and some proposed deregulation for the hydroelectric power industry. The only financial incentive appears to be a 10 percent tax credit for solar and geothermal , both of which may not produce nearly the potential of solar or biomass applications. Why are there no incentives for producers of alternative fuels given that the budget reconciliation act last year contained big tax credits for oil and gas production enhancement?

Answer: Under the Budget Reconciliation Act of 1990, both the ethanol excise tax exemption and the small ethanol producer tax credit were extended to 2000. These represent major incentives for producers of alternative fuels and are now considered a part of the National Energy Strategy (NES).

In the NES hearings, there was considerable public support expressed for accelerated development and/or incentives for alternative fuels. The NES reflects this support in an expanded R&D program for alternative fuels and technologies. Compared with FY 1991 the President's budget requests an additional $14 million for biomass R&D, a 30 percent increase. This research is designed to bring down the cost of these alternative fuels to a level where they are economically competitive. Research is also progressing on other alternative fuels. Moving ahead with this research is more valuable than "incentives" to use the current, more costly generation of alternative fuels production equipment and methods. Furthermore, an additional $15 million has been requested for R&D in vehicle propulsion systems and for electric/hybrid vehicles, an almost 22 percent increase. In the solar area, $311 million has been requested for R&D in photovoltaics between FY 1992 and FY 1996. In addition to this aggressive R&D program, the NES recommends extending through 1992 the business investment tax credit for solar and geothermal systems. Taken as a whole, the NES incentives for alternative energy should significantly accelerate the development and use of alternative fuels and technologies.

QUESTION FROM CONGRESSMAN ROEMER

Question 5: **You mentioned the breakaway from usage to technology in renewable energy sources after the year 2010. Isn't there some way to expedite this breakaway? Very specifically, what technologies are we talking about? Please give me some examples.**

Answer: As you know, there are a number of different renewable energy technologies, and the developmental status of these technologies varies considerably. Several, such as hydropower, geothermal, and waste-to-energy, are cost-effective in many situations today. Others are cost-effective in somewhat more limited markets. Examples of these include wind and parabolic trough solar thermal power systems. Finally, a number of renewable technologies still require substantial progress, in terms of lowered costs, improved performance, or demonstrated capabilities, before they can make significant contributions to our energy supply. Examples of this last group include solar central receiver systems, solar thermal dish electric systems, and photovoltaic power systems.

In our development of the National Energy Strategy (NES), we concluded that the contributions of the more mature renewable technologies would continue to grow. We also expect that most of the technologies identified above will become cost-competitive with conventional power technologies somewhere in the year 2000 to year 2010 timeframe. Thus by 2010, an expanded portfolio of cost-effective renewable technologies will result in a sharp increase in the rate at which renewable technologies are adopted, providing the breakaway that I cited in my testimony.

Several renewable technologies are on the verge of successful commercialization into the mainstream energy marketplace. Examples include wind, geothermal, and solar thermal. These technologies have experienced significant technical progress over the past 10 years. Their commercialization does not require scientific breakthroughs. What is needed is the opportunity to translate R&D progress to practice, removal of market barriers to renewables, and continued, focused R&D to realize the full potential of these technologies.

We also considered a number of other options to more rapidly expand the role of renewables, and several of these are part of the NES. Those options include reform of the regulatory process for hydropower systems, revision of the regulations under the Public Utility Regulatory Policies Act of 1978 (PURPA) to allow renewables to compete in a broadened utility power arena, development of methodologies for incorporating total fuel-cycle costs in energy systems decisions, and extension of the investment tax credits for solar and geothermal energy systems.

QUESTIONS FROM CONGRESSMAN TIM ROEMER

MAGNETIC LEVITATION AND PHOTOVOLTAICS

Question 6: Could you also be more specific on where we are now in magnetic levitation technology and photovoltaics - and how we are in comparison to our international competitors on this timeline (i.e., Japan and Germany on mag-lev train technology).

Answer: Magnetic levitation (maglev) research was conducted in the U.S. in the late sixties and early seventies by several groups. That work included an important patent filed by Powell and Danby, Brookhaven National Laboratory, that covered several aspects of maglev technology including the use of superconductor magnets, linear synchronous motors, and null-flux guidance and suspension. From 1975, when the government terminated virtually all work on maglev, to 1987 very little R&D was done in the United States. In late 1987 and early 1988, the Argonne National Laboratory (ANL), under DOE funding, initiated an assessment of the potential use of high-temperature superconductors in transportation in general and in maglev in particular. ANL also examined the possible market for maglev and the potential benefits that could be derived by implementation in the United States.

As a result of renewed interest partially developed through the ANL work, the Administration announced the establishment of a National Maglev Initiative in February 1990. The program is to encourage private sector participation in advanced maglev design, construction, testing, validation, and certification, with a Federal interagency team developing strategies for the participation by the private sector, addressing technical and economic issues, and setting necessary environmental, safety, and health standards.

The maglev initiative team is led by the Department of Transportation through the Federal Railroad Administration and the Army Corps of Engineers and is supported by the Department of Energy. In FY 1991 the National Maglev Initiative issued two major requests for proposals, i.e., a broad agency announcement to conduct technology assessments regarding various technical and system-wide issues, and a system concept definition request for proposal to develop several system maglev concepts. Current planning for the National Maglev Initiative is to evaluate whether there are advanced prototype maglev designs (including existing foreign designs) that could be commercially viable.

The Germans and Japanese have conducted an aggressive development program for maglev technology over the last ten years. It is estimated that each country has expended in excess of one billion dollars on R&D and construction and operation of test facilities. The German system uses iron-core, normal-conductor wound electro magnets. The current Japanese technology is based on the use of low-temperature superconductor magnet technology circa 1980 to 1985. Both foreign technologies have known problems that include high cost per mile of guideway. The German system is being marketed for limited commercial application. A 13.5 mile demonstration project at Orlando, Florida, is approved for construction with completion scheduled for 1994 or 1995. A 240-mile link between Las Vegas and Southern California using the German system is planned, but the starting date remains uncertain. The first commercial Japanese system based on their present technology is planned for Sapporo, Japan. A newer Japanese technology will require a new test facility that will be ready for use in the mid to late 1990s. Both the Germans and Japanese have full-scale test tracks in operation.

During the last decade the photovoltaic (PV) industry has made significant technical advancements. PV systems have evolved into a commercial and cost-effective energy source for many remote stand-alone and utility applications, such as lighting, communications, switching and rural electrification. The steady progress in PV development is a result of aggressive development of cells and manufacturing technology and substantial investment by both industry and the government. The PV industry has been growing at a compound rate of about 30 percent annually, a record that few high technology industries have been able to equal or sustain. Since the start of the development of photovoltaics for terrestrial use in 1972, module prices have dropped to less than 1/100 of their 1972 prices, from $500 per watt to about $4.00 to $4.50 per watt in 1990, contributing to a twentyfold decrease in PV electricity prices. Modules with efficiencies ranging from 11 to 17 percent are commercially available, and in the laboratory, advanced cells have demonstrated efficiencies as high as 34 percent.

Even though the Federal government invests less in PV R&D than each of our leading competitors (Germany and Japan) individually, we are a world leader in all the PV technologies. The U.S. and Japan both produce about 33 percent each of total world PV module shipments. All of Europe and the rest of the world produce the remaining 33 percent of total module shipments.

Department of Energy
Washington, DC 20585
May 6, 1991

The Honorable George E. Brown, Jr.
Chairman
Committee on Science, Space and Technology
U.S. House of Representatives
Washington DC 20515

Dear Mr. Chairman:

On February 26, 1991, James D. Watkins, Secretary of Energy, testified before your committee on the National Energy Strategy.

Following the hearing, you submitted written questions to follow-up on important issues that were not addressed at the hearing. These questions were submitted on behalf of yourself and Representatives Roemer, Morella, Bruce, Hall, Fawell, Walker, Horn, Valentine and Geren.

At the time of my last letter to you dated April 18, 1991, the response to Representative Geren's question 1a was still outstanding. Enclosed is the response to that question.

If we can be of further assistance to you or your staff, please contact our Congressional Hearing Coordinator, Barbara Barnes, on (202) 586-6341.

Sincerely,

Jacqueline Knox Brown
Assistant Secretary
Congressional and Intergovernmental
Affairs

Enclosure

QUESTION FROM REPRESENTATIVE GEREN

Natural Gas R&D

Question 1a:
Part 1

As you know, the 1990 appropriations by Congress for natural gas-related R&D was $123 million. The Department of Energy has asked for $73 million in FY 92. The gas industry is recommending a 10-year R&D initiative over 10 years, including $215 million in FY 92.

Natural gas consumption makes up 4 percent of our national energy consumption. It has tremendous potential to reduce hazardous air emissions and increase energy efficiency. What percentage of R&D should be devoted to natural gas?

Answer:

The Department does not believe that a percentage of the energy research budget should be automatically assigned to natural gas or any other resource. Allocation of R&D funds among resources or technologies should be based on other criteria such as; appropriateness and need for Federal funding, involvement of private industry, technical opportunities, costs and benefits of R&D outcomes etc. In the case of natural gas it should be recognized that there are significant private R&D efforts in the areas of appliance end uses, engine technology and natural gas supply. In addition, the Gas Research Institute (GRI) has a $200 million per year gas research program in which DOE participates.

The Department believes that its funding request for gas-related R&D activities, under present budget constraints, is sufficient to compliment industry activities.

QUESTION FROM REPRESENTATIVE GEREN

Natural Gas R&D

Question 1a: Part 2 If you believe that only a low percentage of Energy R&D should be devoted to natural gas, why?

Answer: The Department believes its funding request for gas-related R&D activities is sufficient to complement industry activities. The request is not based on a percentage. The Department does not believe that a percentage of the energy research budget should be automatically assigned to natural gas or any other resource. Allocation of R&D funds among resources or technologies should be based on other criteria such as; appropriateness and need for Federal funding, involvement of private industry, technical opportunities, costs and benefits of R&D outcomes, etc. In the case of natural gas it should be recognized that there are significant private R&D efforts in the areas of appliance and uses, engine technology and natural gas supply. In addition, the Gas Research Institute (GRI) has a $200 million per year gas research program in which DOE participates.

The Department believes that its funding request for gas-related R&D activities, under present budget constraints, is sufficient to compliment industry activities.

NATIONAL ENERGY STRATEGY

THURSDAY, FEBRUARY 28, 1991

U.S. House of Representatives,
Committee on Science, Space, and Technology,
Washington, D.C.

The Committee met, pursuant to recess, at 10:05 a.m. in room 2318, Rayburn House Office Building, Hon. George E. Brown, Jr. [Chairman of the Committee] presiding.

The Chairman. Let's get started here as soon as we can. The members will take their seats.

I'd like to make a very brief opening statement. This is the second day of two days of hearing on the Administration's energy plan and strategy. We heard on Tuesday from the Secretary, and we had a very stimulating discussion of the Administration's position on the energy strategy. Today we had planned to hear from the Honorable Leon Panetta, who has submitted legislation with a somewhat different energy strategy focus, and a distinguished panel of public witnesses who have each established a long record of concern about energy policy matters. We wanted to get their viewpoints.

Mr. Panetta is temporarily detained in a meeting with the leadership, so I'm going to ask the panelists to come forward at this point. When Mr. Panetta arrives I will ask him to join the panel and, if I may have the indulgence of the other members, out of courtesy to a Member we'll let Mr. Panetta make his statement at the time that he arrives.

Are we missing a—we've got everybody here, I guess. We don't have a—who's missing? We have Mr. Nitze's name and Mr. Singel's face. We'd better get another card up there. They're not all here apparently. Is Mr. Nitze expected?

Mr. Nitze will be here shortly. All right.

Do we have a statement on the Republican side from anyone who desires to be heard?

[No response.]

The Chairman. Thank you very much.

The Chair intends to continue with the effort to make sure every member gets a chance to ask questions, and to do that we are going to start the questioning with the members who did not get an opportunity on Tuesday to ask questions. I think all the members should have observed by now that at a full committee meeting when we have good attendance there is not time enough to give everybody five minutes, and therefore certain accommodations have to be made. The Chair is sensitive to that and will try to make sure that every member has an adequate opportunity in one way or another.

The Chair has also been castigated for not taking up enough time with long speeches and questioning of his own, and I think that I may have to remedy that problem a little bit, too. The Chair does not like to be castigated for his reticence.

[Laughter.]

The **Chairman**. All right. I think we will proceed then in the order which the schedule shows with Doctor John H. Gibbons, Director of the Office of Technology Assessment now. I worked with Doctor Gibbons for many, many years, and I have a very high regard for his views. Not only has he directed the Office of Technology Assessment with distinction—and that office has conducted many outstanding studies of the energy problems—but in prior life Doctor Gibbons had even more experience with energy policy problems and his wisdom is appreciated.

In addition to Doctor Gibbons, we also have Mr. S. David Freeman, General Manager of Sacramento MUD—again, a person who has had a distinguished career on energy policy matters over many, many years.

In addition, Mr. Nitze, when he gets here, president of the Alliance to Save Energy, will have a contribution to make from his standpoint.

And we are indeed privileged to have the Honorable Mark Singel, Lieutenant Governor of the State of Pennsylvania, here with us today who can give us a perspective from the standpoint of State government as to some of the elements that we need to be thinking of in energy policy.

I'm going to ask each of the panel members to make a reasonably brief statement, and we will hear from each of them and then we will ask questions as a panel after they have completed their statement. And, of course, as I mentioned, if Mr. Panetta gets here we will treat him with special regard because he is Chairman of the Budget Committee.

With that, Doctor Gibbons, you may proceed.

STATEMENT OF JOHN H. GIBBONS, DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT, WASHINGTON, D.C.

Mr. **Gibbons**. Thank you, Mr. Chairman.

I have to apologize for my voice this morning. If I run out of words I will use pictures.

I would like to submit my written testimony for the record, Mr. Chairman, and summarize it within the time frame that you have provided.

The **Chairman**. Without objection.

Mr. **Gibbons**. Let me say three things about energy, Mr. Chairman, and then make one or two comments about our impression of the National energy strategy. This comes after a decade or more of thinking about energy issues.

The first point I'd like to make is that, however pervasive in human activities, energy per se is not important. It is certainly not a goal within itself. It is how energy relates in either serving or frustrating to more important and fundamental goals that energy becomes important. It is how it relates to our goals of economic health and strength of our environmental quality, or our National security. It is those over-arching goals that we should think about energy and judge the merits of various energy strategies. The strategies, in other words, should be chosen to reflect, as best they can, simultaneously these several over-arching National goals.

Number two: however great the need for short-term contingency planning in energy such as the strategic petroleum reserve, energy is fundamentally a long-term, National—yea, global—issue that is multi-decade. Energy is also not a pure market phenomenon. It is, rather, manipulated by non- market events and by would-be monopolies that derive from the geology of energy resources. Therefore, any sensible energy strategy must include both public and private sector participation and reflect long-term commitments to its resolution.

Now, in reflection of these first two points, OTA, in our written testimony for you, offers a three-pronged candidate set of energy goals that would reflect the comments I just made. I brought along a couple of charts. They reflect figures one, five, and six in my written testimony. And let me mention these three goals.

First of all, a goal of reestablishing our progress in terms of increased energy efficiency in our Nation. If you look at the yellow bars on my chart to the right, you will see that the ratio of energy to gross National product was rather steady through the years following World War II up to about 1970. With the price change in energy and new attention to it, the ratio began to fall, and we have gained a very impressive degree of efficiency in our National energy system since the early 1970s. Unfortunately, that has begun to play out as we focused less on energy policy and as real energy prices began to move downward.

A goal for our Nation that we believe matches the past — is even, indeed, not quite as optimistic as the past—but is a worthy one for the future, is to return to about a 2 percent per year improvement in energy efficiency for at least the next 20 years. It can be done if we like to be smart about the way we do things.

Our second strategy is to make definitive steps in the direction of moving from our fossil-fuel-based economy to a non-fossil future with natural gas and other low-carbon resources as part of the intermediate progress in that direction. A candidate goal would be to move by perhaps 1 percent per year toward the time in which we find non-fossil fuel supplies replacing fossil fuels. We used to think we had 300 years. We now realize we may have only half a century. If we start now we can make it, but we can certainly not delay.

The third point, illustrated by this next chart on the wall, from figure five in my testimony, focuses on oil. Using IEA number and our own analysis, we find the following rather discouraging situation, namely that our domestic production of oil, reflected in the green part of those curves, is falling away from our total demand reflected by the red portion of the curve. That is, the red portion is the amount of oil we have to either import or will have to import unless we change things.

There is an old Chinese statement that says "If we don't change our directions, we are liable to end up where we are headed." If you look at that chart, you see we are headed into deep water, deep trouble. The question is what do to about it.

Well, the next chart shows a very simple set of circumstances that could lead us toward a candidate goal of reducing or holding our imports of oil to no more than 50 percent, and we have devised a number of strategies, both on the supply side of enhancing domestic production, increasing renewable fuels; and on the demand side, especially in the transportation sector which accounts for so much of our oil consumption these days.

We show that you can have a goal of holding our imports to 50 percent and diversifying those imports, and there are a variety of reasons for doing it which include the very disturbing situation that we now spend—about 57 percent of our net balance of payments internationally relates to these energy imports.

So there are some strategies one can devise that take time but could enable us to achieve such a goal.

Finally, Mr. Chairman, I'd like to briefly refer to the National energy strategy.

There is—you know Alice in Wonderland, in which Alice began to talk to the captain. Alice says, "Cheshire puss, would you tell me please which way I ought to go from here." And the cat says, "That depends a good deal on where you want to get to." It seems to me in the NES, as well as other considerations of our Nation's energy future, we need to talk about where we want to get to.

As we interpret the NES—and, of course, we have not had a chance to study it very carefully yet—we interpret it as saying that oil imports should be 45 percent by the year 2010, a much more optimistic and dramatic number than we see as possible, even with a very concerted program. We also see the plan calling for increased domestic production of oil and alternative fuels production amounting to almost four million barrels a day by the year 2010—again, a lot more optimistic future than we have been able to display in our calculations.

And, finally, through increased efficiency, albeit without even mention of automobile fuel efficiency standards, of nearly three and a half million barrels a day. Our response is that the devil lies in the details. Getting beyond noble goals is very important, and the question is: why 45 percent, for example? We see it tough to hold at 50 percent. What is the right number? It seems to me that number depends on how much diversification of imports we have. Where is the beef is the old statement. We feel that the goals may be very worthy, but we are very interested in finding out what real meat lies behind the goals in terms of an achievable future.

I have, Mr. Chairman, two figures that relate to the Department of Energy's expenditures over the past couple of decades that I would also like to submit for the record, if I may, sir, and will pass them to you.

The **Chairman**. Without objection they will be made a part of the record.

Mr. **Gibbons**. And I would like to close by saying I think a test of the seriousness of the National energy strategy would be to examine the Department of Energy's so- called "out year" budget proposals and whether or not these have gone through OMB to find out how long we are now prepared in the Administration's plan not only to put a plan in place, but to give it the necessary long-term commitment.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Gibbons follows:]

TESTIMONY OF JOHN H. GIBBONS
DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT
UNITED STATES CONGRESS
BEFORE THE

HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

February 28, 1991

THE CONTEXT FOR U.S. ENERGY POLICY: CURRENT PATHS AND OPPORTUNITIES FOR THE 1990'S

Mr. Chairman and Members of the Committee:

I am very pleased to appear today to testify on the subject of our nation's long-term energy future. As the Committee begins its agenda this session under new "management," it seems natural that the nation's energy future be given early consideration. It is important not only because events and problems ranging from the Middle East war, to global climate change, to the balance of payments deficit constantly underscore a current sense of urgency about energy issues, but also because it is imperative that energy policy be viewed from a long-term perspective, many aspects of which are the interest and jurisdiction of the Committee. In particular, today I will argue that a comprehensive, strategic national energy policy needs to derive its direction from broader and more fundamental national goals of **economic health, environmental quality,** and **national security.** Therefore, as we consider the steps necessary to develop a national energy strategy, it only makes sense to develop that strategy in ways that do the best job of supporting these three and other related goals.

As most of you are aware, OTA has been studying energy issues for the Congress since the mid-1970's, many studies of which were requested by this Committee. I have attached to my testimony today a selected list of reports which we have delivered to the Congress on energy topics that are relevant to today's hearing.

As Congress considers the President's National Energy Strategy and the now over 60 other pending energy-related legislative proposals, some of the options may support one goal but run counter to the others. For example, increased reliance on coal could cut oil import dependence, but exacerbate problems of air pollution and global climate change. Some energy options support all three goals, particularly those that improve efficiency of production and use. Therefore, today I would like to recap a number of the long-term U.S. energy technology and policy trends, discuss their interaction and implications, and finally offer several specific strategic energy goals for your consideration.

First, I want to emphasize that there are no energy "fixes" that are easy or quick, i.e., no magic bullets. For example, **we will succeed in easing U.S. oil import dependence only if we establish long-term efficiency and supply goals, and stick to the plan to achieve those goals through periods of both crisis and calm, and through periods of varying oil prices.** During the past decade, steady supplies, easy efficiency gains, and a retreat in the price of oil seduced us into largely abandoning efforts to push research in energy efficiency and alternative supplies. The present crisis, too, will pass, possibly again beguiling us into a false sense of energy complacency. Major changes in energy systems--and major changes are what must occur--require decades and unwavering commitment from citizens, political leaders, and industry. The good news is that, given time, energy is a flexible component of a modern economy. However, a long time is required in order to effect a major turnover of the capital stock of energy supply and consuming equipment. Short-term strategies -- either to spur production or to curb consumption -- are often inefficient and traumatic. **Certainly, a sensible, comprehensive energy policy must be responsive to sudden changes of events, but it must be fundamentally grounded in long-term strategies.**

WHERE WE ARE HEADED

Each year the world consumes roughly a million years' worth of nature's stored energy wealth. Global energy use grew from about 18 Quadrillion Btus (Quads) -- about 800 million tons of coal equivalent (tce) or about 8.5 million barrels of oil per day (mbpd) equivalent -- in 1900 to 333 Quads in 1989. The industrialized world accounts for 70% of annual worldwide commercial energy consumption. Coal, oil, and natural gas currently supply about 80% of this demand, with a growing contribution from nuclear energy. Many developing countries still depend heavily on non-commercial fuels, such as wood, dung, and crop wastes, but as their economies develop, they increasingly incorporate fossil fuels, especially coal and oil, in their industrial and commercial sectors.

In the United States we currently consume about 84 Quads of energy. Many analysts project that by the year 2010 the U.S. will consume over 100 Quads of total energy (the U.S. Department of Energy [DOE] recently projected a "base case" of 108 Quads).[1] With no changes in policy and "standard" economic assumptions, the sources of energy we use to fuel the economy are expected at that time to be very similar to what they are today: about 40% oil, about 20% natural gas, about 25% coal, and about 15% renewables and nuclear power.[2] Still, some important features of U.S. energy supply and demand balance are changing and, in turn, are changing the environment within which policy decisions will be made. These changes also suggest that total energy consumption could be much different from these forecasts. Today, I will address three of the most significant changes since the 1970s: (1) the steeply declining energy intensity of the U.S. economy, (2) the increasing U.S. reliance on foreign sources of oil, and (3) the changing structure of the electric utility industry.

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[1] U.S. Department of Energy, Annual Energy Outlook, DOE/EIA-0383(90), 1990. This baseline scenario is also adopted in the National Energy Strategy: Powerful Ideas for America, February, 1991.

[2] See, for example, the 1990 DOE Annual Energy Outlook, produced by the Energy Information Administration, DOE/EIA-0383(90).

Declining Energy Intensity.

For many years most observers believed that energy use and GNP were immutably linked, moving upward in lock step. We learned from the energy shocks of the 1970's, however, that ingenuity can substitute for supply when the price is right. When energy prices move up, people respond by shifting their market basket of purchases and by developing more efficient ways to provide energy services. The energy intensity of the economy, the energy consumed per unit of GNP produced, fell 2.5% per year over the last decade, most of which was due to improved efficiency (see Figure 1).[3] This steady change in energy intensity also reflects changing patterns of consumer demand, a shifting balance of imports and exports of both energy and non-energy goods, and the changing market basket of goods produced in the United States.

Sharply Increasing Dependence on Foreign Oil.

Today, the world consumes about 65 million barrels of oil daily (MBD). The U.S. consumes about 17 MBD, which continues to be about 25% of the total world consumption. This consumption rate is about 2 MBD more than in 1983 – a 14% increase. However, due to depletion of low-cost resources and lack of new discoveries, the level of domestic oil production is down sharply in the U.S. The net result is that imports rose from about a third of total U.S. consumption in 1983 to nearly half in 1990.[4] Moreover, the fraction of total imports coming from Persian Gulf nations has increased from about 4% of total U.S. consumption (10% of total U.S. oil imports) to over 10% (26% of current U.S. imports). See Figures 2 and 3.

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[3] OTA addressed the changing energy structure of the U.S. economy in its 1990 Background Paper, Energy Use and the U.S. Economy.

[4] This is addressed in OTA's 1987 report, Impact of Low Oil Prices on Domestic Production and in its 1989 report, Oil Production in the Arctic National Wildlife Refuge: The Technology and the Alaskan Oil Context.

As we have found once again in recent months, diversity and flexibility in oil supply are intimately linked with national security. U.S. energy security is predominately threatened primarily by our growing dependence on imported oil, especially on the insecure and volatile sources of supply in the Middle East. The Organization of Petroleum Exporting Countries (OPEC) controls three quarters of proved world crude-oil reserves, including all major recent additions. Dependence on imported oil strains the balance of payments of both the developing and the industrialized world. In the first half of 1990 the U.S. imported $24 billion worth of oil, an amount equal to 57% of our total trade deficit for that period. In addition, even in peacetime, without significant crisis, the Pentagon spends many billions of dollars to protect oil supplies. Today, as Operation Desert Storm enters its most costly phase by any measure, this energy-linked bill will rise substantially and rebuilding the war-torn countries of the Middle East may also prove expensive. As the Soviet Union, the U.S. and other non-OPEC nations deplete their best oil reserves, the geopolitics of energy will repeatedly focus on the comparatively vast resources in the Middle East.

Change in the Electric Utility Industry.

The U.S. electric utility industry has weathered dramatic change in the last two decades. A dominant factor precipitating change in the 1970s was price. Utilities had to pay, on average over 200 percent more for fossil fuels in 1984 than in 1972, but since 1984 prices have been fairly stable and are projected to stay stable for the next decade by many analysts (although there is considerable disagreement). In the 1970s construction costs of new power plants, particularly nuclear, rose dramatically due to a combination of factors: increased attention to environmental and safety issues (contributing to extended construction lead-times and added equipment costs), a continuing unpredictable economic regulatory environment, an inflation-driven doubling of the cost of capital (that has since subsided), and in some cases poor management. The higher costs of fuel and capital meant higher electricity costs, and utilities sought higher rates for the first time in decades. In addition most utilities (and everybody else) seriously underestimated the price elasticity of electricity demand. Growth in demand plummeted from 7 percent a year to less than 2.5 percent by the end of the decade as consumers used electricity more efficiently.

Since 1986, the demand for electricity has picked up substantially and, as a result, a crucial legacy of the 1970s and 1980s is the uncertainty in future electricity demand growth. We have found since the 1970s that users of electricity are able to alter the quantity they used much more quickly than utilities could accommodate these changes with corresponding changes in generating capacity. Utilities now seek technology that comes in smaller unit sizes that can much more flexibly meet uncertain demand growth. Confounding the problem is changing nature of demand. There is saturation in some markets, such as many major appliances in homes. The future of industrial demand is clouded as some large industrial users of electricity are experiencing declines in domestic production due to foreign competition while others are returning, like steel. At the same time, rapid growth continues in other areas such as space conditioning for commercial buildings and electronic office equipment. Predicting the net impact of these offsetting trends, along with continued movement toward increased efficiency, has greatly complicated the job of forecasting demand.

The major changes in the industry in recent years and many likely future changes stem from the effects of the Clean Air Act Amendments of last fall, the emergence of an independent power producer industry and other signs of increasing competition in the industry (such as a number of major mergers and acquisitions and proposals to modify the Public Utility Holding Company Act), the accelerating trends of least cost planning and other innovative State regulation, more attention to demand side management, and the emergence of natural gas as an increasingly important fuel for electric power generation. In the face of these changes, long term projections of basic characteristics of U.S. electricity supply and demand are difficult. Nonetheless, none of the changes suggest dramatic changes in the fuel mix of the electricity generation, which, without significant action, will still be dominated by fossil fuels, notably coal, tempered somewhat by natural gas. The DOE forecast of fuel use in electric power generation is shown in Figure 4. As the figure shows, today about 55 percent of U.S. power generation is fired by coal and in 2010 that fraction is projected to grow to 60 percent.

CANDIDATE ENERGY POLICY GOALS TO REFLECT A NATIONAL ENERGY STRATEGY

Long-term energy policy goals must be responsive to the three long-term policy interests of economic health, environmental quality, and national security, because energy's importance is mostly gauged by its ability to sustain these goals. The following prospective energy goals are aimed at this end.

Oil.

Our dependence upon oil imports is increasingly discomforting. Unless substantial steps are taken, that dependence will grow dangerously high within a few decades. **Candidate goals to reflect the strategy of limiting oil import dependence are (1) to limit overall oil imports to 50% of consumption and (2) diversify sources of world oil production and therefore U.S. sources of imports to regions of the world outside the**

Middle East where such imports can be aligned with other U.S. policy interests.

Supply mechanisms to achieve such goals include sustained or slower decline in domestic oil production, developing and producing alternative transportation fuels, and spurring development of petroleum resources in regions such as Asia and South America. Demand and fuel-switching mechanisms include improved efficiency of use in all sectors and shifting of industrial, residential and commercial oil use into other sources such as natural gas or electricity. We address some of these options in more depth later.

Energy Efficiency.

OTA's studies over the past decade have consistently shown that energy efficiency is an essential cornerstone to a comprehensive energy policy framework. About two-thirds of the falling U.S. energy intensity of the last decade is attributable to improving energy efficiency. Efficiency gains have also affected electricity use, which historically has grown faster than the economy but, in the last decade, has fallen back to the same rate of change as GNP. Moreover, **these efficiency gains have generally come about without sacrifice of comfort or dollars, but with net cost savings.** Considerable future energy efficiency gains are still possible in all sectors of the economy using existing technology. Even greater cost savings and efficiency gains will be possible with technologies under current research and development. **An efficiency goal of sustained improvement of 2% percent per year for the next two decades is realistic for the U.S.** With more vigorous research on energy efficiency, coupled with leadership and investment, this goal can be met or exceeded--and with options that are certainly no more costly than pursuing the supply-side path. Moreover, pursuing such a goal appeals to all three policy interests of economic health, environmental quality, and energy security.

Environmental Quality.

A responsible energy policy will complement as much as possible a responsible environmental policy. Clearly there are some activities that might spur our economy and enhance national security but run counter to environmental goals (e.g., aggressively pursuing a long-term strategy of alternative transportation fuels such as methanol, but allowing the ultimate feedstock of these fuels to become coal rather than biomass). But those should be seriously considered only if we've exhausted other options that more generally support all three goals (e.g., developing economical fuel cells that burn fuel efficiently and cleanly to power automobiles).

With a wealth of existing or in some cases near-commercial technology, we see no reason why existing environmental goals need to be compromised to achieve energy goals. Energy and environmental goals are, of course, closely linked and, therefore, neither energy nor environmental policies should be developed or changed in isolation. For example, over half of U.S. electricity generation today is fueled by coal, the major source of SO_2 and CO_2 emissions. Long term policies to improve the efficiency of electricity use directly translate to reduced emissions.

SOME FUTURE SCENARIOS: IMPLICATIONS OF ENERGY POLICY GOALS

In order to illustrate the implications of the policy goals I have outlined above, let me relate them more specifically to strategies affecting U.S. oil production and use and to concerns over reducing greenhouse gas emissions in U.S. electricity generation and use.

Future U.S. Oil Import Dependence

The current crisis in the Middle East has focussed attention once again on energy security concerns and, in particular, on strategies for reducing U.S. dependence on imported oil. In Figures 5 through 7, we summarize the impacts--in size and timing--of several aggressive strategies in supply, efficiency, and fuel shifting. The options include improving automotive fuel economy, increasing domestic production of oil, switching to alternative fuels in transportation, and a mix of fuel-switching and improved efficiency steps in industry and the residential/commercial sector.

As you can see from the figures, **clearly, vigorous and sustained efforts would be required to hold down oil import dependence over the next several decades--even to a level of 50%**. The biggest opportunities lie on the demand side. Fortunately, these can provide good jobs and important new economic activity and strength at home. To the extent that we improve efficiency cost effectively, supplies will last longer, economic competitiveness improves, environmental problems will be eased, and international tensions lessened. But improved efficiency, however dramatic, won't be enough. The opportunities on the supply side, such as enhanced domestic production in the lower 48 states, offshore and in Alaska, are more modest than increased demand efficiency, but still important. And there are various opportunities for using alternative transportation fuels such as methanol, CNG, electricity, and others. These fuels have extensive long-term implications, however. The oil replacement potential must be weighed against the energy and environmental costs associated with producing and using these fuels. Last fall OTA released its assessment report, Replacing Gasoline: Alternatives for Light-Duty Vehicles, that addresses this subject in more depth.

Pacing of all the efforts described above is an essential feature: **like making a turn in a fully loaded supertanker, change in the energy system must be given time if it is to be non-violent.** Patterns of energy supply or demand can change radically as technology changes and as capital stock turns over but we have learned that short-term changes or policy and technology "quick-fixes" can frequently lead to economic hardship and inefficiency.

We focus on three basic scenarios in Figures 5-7. The first is a baseline adapted from the Energy Information Administration's (EIA) Annual Energy Outlook for 1990 (Base Case).

Scenario I: Baseline. Baseline values for oil production from Alaska and the lower 48 were extended to 2020 by continuing the 2005 to 2010 trend projected by the EIA. Natural Gas Liquids (NGL) were similarly left at the EIA projected levels to 2010, and then extended to 2020 following the same trend as 2005 to 2010. The category "Other" (e.g., miscellaneous refinery products) was frozen at the EIA 1995 level of 0.8 MMBbl/day; levels in the EIA projection above 0.8 MMBbl/day were separated out under the category "Alternative Fuels I" and were added in separately (see Figure 5).

The EIA projection assumes U.S. new vehicle fuel economy reaching 38 mpg for new cars and 24.4 mpg for new light trucks in 2010 -- designated the 38 mpg case in

Figure 6. Our base case (Figure 5) adjusted the EIA projection to reflect a continuation of the current level for new cars of 28 mpg and for new light trucks of about 21 mpg -- the "Base Case" (28 mpg) case.[5]

Scenario II: New Supply and Efficiency Improvements. Figure 6 illustrates the impacts of three new sources of supply assumed to begin coming on line in the year 2000 and three levels of transportation efficiency improvements phased in gradually through the year 2020.

The line labeled "Alternative Fuels I" assumes that fuels such as methanol, ethanol, etc. are added beginning in 2000 reaching 500,000 barrels per day by 2020, increasing at a capacity of 100,000 Bbls/day every five years.[6] The line labeled "Alternative Fuels II" is an accelerated development case.[7] The line labeled "Alaska II" assumes that a large new field is found in Alaska and an accelerated development effort is assumed to result in production levels rising to 500,000 Bbls/day by the year 2005.

Figure 6 also depicts three different transportation efficiency improvement strategies, shown as "Base Case (28 mpg)", "38 mpg", "50 mpg", and "Trucks". The case of 28 mpg and 38 mpg cases were discussed above. The 50 mpg case assumes that by 2020 both new cars and new light trucks have an overall weighted average fuel efficiency of 50 mpg, resulting in an average on-the-road total fleet fuel efficiency of 36 mpg by 2020 (allowing for turnover of the fleet stock and for the 20% reduction in actual on the road efficiencies from CAFE-type standards). The case "Trucks" assumes that half of the diesel fuel (heavy trucks, buses, etc.) projected to be consumed by 2020 (EIA projection to 2010 extended at the same growth rate to 2020) could be backed out by 2020 through, for example, the use of compressed natural gas and increased efficiency.

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[5] This resulted in a change in weighted (cars and light trucks) fleet average mileage from EIA projected levels of 23.5 mpg (38 mpg case) in 2010 (on the road mileage is assumed to be 80% of that measured by a CAFE-type standard) to 20.5 mpg in 2000 (28 mpg case) which was then kept at this level till 2020. Corresponding annual percentage changes in mileage (on-road fuel economy of the total fleet) are 1.18% in the EIA projection (38 mpg case) carried through to 2020, and 1.0% in the 28 mpg case until 2000 and then left unchanged from 2000 to 2020.Increasing light-duty vehicle efficiencies are counterbalanced, however, by EIA projections of an increase in Vehicle Miles Traveled (VMT) of 1.82% per year from 1988 levels through 2010. This was assumed to continue to increase at this rate through 2020. This is driven by such factors as population growth of 0.8%/year (246 million in 1988 to 307 million in 2025) and real GNP growth of 2.4% per year overall or about 1.6% per year per capita.

[6] These estimates are derived from the EIA Base Case as described above and are comparable to the estimate of the white paper, Solar Energy Research Institute, "The Potential of Renewable Energy" (SERI/TP-260-3674, March 1990) for the "Business as Usual" case.

[7] The accelerated development case listed in the above SERI white paper which foresees alternative biomass derived liquid fuels reaching 1.8 MMBbls/day more than in the base case by 2020 if additional RD&D funding is made available.

Scenario III: Aggressive Oil Backout. Figure 7 includes further oil backout. It assumes (in addition to 50 mpg and trucks) that one-half of the remaining non-transport uses of oil will be backed out in an aggressive oil conservation and fuel conversion program. This results in a savings of 2.7 MMBbl/day by 2020, phased in linearly.[8] Compared to current rates of use, this would suggest oil savings in the EIA Base Case of about one-half in the residential and commercial sectors, and one-third in the industrial and utility sectors from what it would have been in 2010 if energy use were to grow linearly with economic activity and/or population.

The lesson from these scenarios is that much can be done to countervail against the ominous projected growth of oil import dependence, but that even with relatively heroic measures we face a future of high dependence on imports. We are not as optimistic here as the Administration's position in the National Energy Strategy.

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[8] The EIA Base Case Scenario already envisages annual residential and commercial consumption of oil decreasing at 2.6% and 1.8% respectively between 1990 and 2010 while population grows at 0.6% and total real GNP grows at 2.4% annually. Oil use in the utility and industrial sectors is assumed to increase at about 0.7% per year each, while electricity generation and manufacturing output are assumed to increase 3% and 2.8% respectively per year.

Linking U.S. Energy Strategy to Global Climate Concerns

For decades we assumed that fossil fuels can supply our energy needs for several more centuries. Our only serious "bet-hedging" to fossil fuels has taken the form of work on harnessing nuclear power -- fission and fusion. While the latter goal remains frustrating and elusive, the former now accounts for 20% of U.S. electricity, or about 8% of our total primary energy budget. Other non-fossil (mostly-hydroelectric and biomass fuels) adds another 8%, so our present non-fossil energy budget is about 16%. But the nuclear fission enterprise, for several reasons, is in deep trouble -- so deep that the requirement to rescue it could well be more difficult than the original task of creating it. And our long-term efforts to harness solar energy -- directly or indirectly through wind, biomass, hydropower or other means -- are minimal, ephemeral, and also potentially troubling in terms of environmental impacts if massive use evolves.

The rising specter of air pollution and climate change casts an ominous shadow over the fossil option. The fossil era may need to end, not in centuries, but in a century or less. **This means that, unless we ignore, at our peril, global climate change, solar and nuclear power (fission and fusion) must be considered as the energy sources for mankind that may soon have to become globally dominant, perhaps within fifty years.** Developing and preserving nuclear and solar options are certainly possible. They also require long-term commitments of research, development, and investment which, in turn, means we must move ahead on that odyssey now. **A prudent candidate goal for U.S. energy policy is to reduce fossil intensity of U.S. energy use on average 1% per year for at least the next two decades.** The number I mention for this goal is less important than the will to pick a number and vigorously pursue it. Economically attractive energy efficiency improvements would dominate the first decade or two, securing time to allow non-fossil alternative transportation fuels and sources for electric power generation to develop systematically and efficiently .

Three weeks ago OTA released the summary of its assessment report, Changing by Degrees: Steps to Reduce Greenhouse Gas Emissions, that outlines the technical steps that would be necessary to reduce U.S. carbon dioxide emissions. In that analysis, we examined several alternative scenarios, summarized in Table 1 and Figure 8. In addition to a "Baseline" scenario, OTA constructed a so-called "Moderate" scenario that involved measures typically requiring some capital investment but later saving money through fuel savings, which in most cases more than compensated for initial costs (see Table 1). While none of the measures included in this scenario are difficult to achieve technically, inducing consumers to use them may not be easy. Another so-called "Tough" scenario, lowers energy demands further than the moderate case, but includes measures that cost more for the same level of convenience or comfort and measures that will be technically difficult to achieve. All of the measures in the Tough case are technically feasible, but while most are not based on best available prototypes or practices, OTA made judgments about what would be feasible for widespread use. Implementing the technically feasible Tough measures would be challenging--politically, logistically, and economically. **The net compliance cost of the tough scenario is inherently uncertain but would range from better than break-even to perhaps $150 billion per year, depending upon a variety of factors such as future energy prices.**

OIL AND ENERGY SECURITY: THE MAJOR OPPORTUNITIES

As we see and hear the haunting images of the war in the Middle East, many of us reflect on the events of the last decade that got us to this point. We must attribute at least some of the rationale for our military presence in that part of the world to our dependence on that region's oil reserves or, in the President's words, "U.S. economic interests there." The major opportunities for reducing oil import dependence are (1) improving transportation fuel efficiency, (2) increasing the use of existing alternative transportation fuels such as methanol, compressed natural gas, ethanol, and electricity and, in the longer term, alternative fuels from other resources such as biomass or solar energy, (3) increasing domestic production of oil, and (4) promoting diversity in international sources of supply.

Automotive Fuel Economy

Automobiles and light trucks account for 40 percent of U.S. oil consumption. The efficiency of the new vehicle fleet increased sharply in the 70s with the advent of higher mileage standards and fuel prices. But gains have ceased in the face of government apathy and consumer preference for increased vehicle acceleration, size, and other characteristics that conflict with improved fuel economy.

OTA believes that there *is* a substantial potential for further fuel economy increases through purely technological means (i.e., without diminishing consumer choice), but the magnitude of this potential within the next decade is not what we would like it to be. We can identify a reasonable set of technology that would allow a new car fleet fuel economy of about 30 mpg by 1995 and 37 mpg by 2001, both values measured according to the EPA test procedure and assuming that the current mix of vehicle size and weight for the U.S. fleet remains constant.[9] Longer term progress, beyond the year 2000, could be strong *continual* incentives for fuel economy are brought to bear on the industry. If Congress believes that even larger gains in fuel economy are necessary beyond that which can be achieved with strictly technical fixes, then it could stimulate a basic shift in the size and performance of the fleet either through regulatory or economic means.

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[9] These values assume that each manufacturer is required to meet a company-specific standard that reflects its particular technological capability. By using all technologies identifiable today as likely to be achievable for 2001 model year regardless of cost, and assuming a rollback to 1987 size and performance, we believe the entire U.S. fleet could achieve 38-39 mpg. OTA is currently completing an analysis of automotive fuel economy at the request of the Senate Energy and Natural Resources Committee and expects to deliver a report in several months.

Because today's auto purchasers feel free to choose among both the automobile fleet and the fleet of minivans, vans and light trucks in their selections for passenger transportation, Congress will have to exert the same pressure on all these vehicles if its fuel economy goals are to be met, especially since vans and light trucks escape the discipline of the present standards for passenger cars (see Figure 9). In OTA's study on Global Climate Change (noted earlier) the options for improving automotive fuel economy included scenarios that permitted altering mix of vehicle size and weight for the U.S. fleet as well as aggressive introduction of technical improvements, including a shift to diesel engines. Under such assumptions, new car fleet efficiencies of 42 mpg by 2000 and 58 mpg by 2010 might be achievable.

Alternative Transportation Fuels

The transportation sector of the U.S. economy consumes almost two-thirds of our total supply of domestic and imported oil. Obviously, the growth of non-oil based liquid fuels is an important adjunct to increased fuel economy and increased domestic oil production (in reducing U.S. dependence on imported oil). A recent OTA analysis of several alternatives to gasoline[10] shows that alternative fuels present a key opportunity to reduce U.S. oil dependence. Over the next few decades, alternative fuels derived from natural gas -- methanol and compressed natural gas (CNG) -- and from biomass should be capable of substituting for a significant fraction of transportation petroleum use. The worldwide resource base for natural gas is very large, and considerable volumes of undeveloped gas resources exist outside of the Middle East, including large volumes in the Soviet Union. Electric vehicles, perhaps employing not only batteries, but fuel cells or small engines, could also be important possibilities in some regions of the U.S. This, of course, depends on the pace of research and technology development and the constraints on other options. For example, last year California passed legislation requiring deployment of some "ultra-low polluting" vehicles.

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[10] U.S. Congress, Office of Technology Assessment, Replacing Gasoline: Alternatives for Light-Duty Vehicles, October 1990.

Coal-based liquid fuels currently are considerably more expensive than natural gas-based fuels. However, continued development of the fuel production processes have lowered costs and, in the future, may lower costs sufficiently that this source could compete economically with fuels from natural gas. Large U.S. coal reserves make coal-based liquid fuels attractive if energy security is viewed in isolation. However, even "clean" coal use presents serious environmental problems (especially CO_2 emissions), and the nation cannot afford to ignore these in the process of deciding which liquid fuel strategies to pursue.

In the long term, we must chart a course beyond fossil fuel dependence in transportation. That means electricity and hydrogen, both obtainable from nuclear and solar sources, but both have serious cost, engineering, and other constraints and will require a major development effort. Over the next century, however, they could greatly diminish greenhouse gas emissions by progressively replacing fossil-based transportation fuels.

Increased Domestic Production

The steady decline in U.S. oil production could be slowed somewhat as enhanced oil recovery technology matures and is applied.[11] This decline and the scarcity of new opportunities for finding large new oil fields within the lower 48 leads some to suggest that the federal government open to exploratory drilling and development a number of promising areas currently off-limits to such activities. The oil industry considers the coastal plain of the Arctic National Wildlife Refuge (ANWR) to be the United States' most promising remaining prospect for finding giant oil fields, and they have made it the central focus of the debate for opening new areas for commercial exploitation. The Department of Interior has estimated that ANWR has a 45 percent chance of containing economically recoverable oil, with a mean estimated oil volume of 3.5 billion barrels -- a potential resource equivalent to the third largest discovery in U.S. territory that, for a few decades, could deliver several hundred thousand barrels of crude oil per day to the lower 48 States.

Groups opposing development view the coastal plain as a unique and invaluable Arctic ecosystem and wilderness area, and are convinced that development would destroy the plain's wilderness character and seriously damage its wildlife and other environmental values. They also point out that relatively modest investments in energy efficiency could result in saving a similar amount of oil over the same period of time.

The debate over ANWR development is a classic battle between environmental and certain energy supply interests.[12] Although an exploration program could be conducted with little damage, development and production would most likely cause disruption and damage. In any case, oil could not start flowing from the plain for many years. The industry's own estimates of the time from actual leasing of the plain (which itself will take a few years) to production startup is about 12 years, and peak production would not be reached for a number of years after that. Even if Congress were to act swiftly to open the coastal plain to exploration, with an accelerated leasing schedule, and if the industry successfully discovered oil and were to move as rapidly as possible, it is difficult to see how substantial production could begin before the year 2000.

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[11] U.S. Congress, Office of Technology Assessment, U.S. Oil Production: The Effect of Low Prices, Special Report, September 1987.
[12] See U.S. Congress, Office of Technology Assessment, Oil Production in The Arctic National Wildlife Refuge, February 1989.

Diversity in Oil Supply

The supply of recoverable world oil resources is huge, but much of it in the Middle East. Furthermore, with industrializing nations seeking increased imports, **it is not safe to presume that the U.S. can count indefinitely on 8-10 MBPD oil imports at an attractive price.** If we could help the Soviets expand oil production in return for a share of it, for example, that could have several benefits to us. First of all, because of the limited exploration and poor production to date and the existence of major sedimentary basins, it is a very attractive region to explore and develop. Second, success in increasing U.S.S.R. oil exports would not only diversify the U.S. import base but also provide the Soviets with hard currency so badly need to maintain peaceful progress toward a viable market economy. A second example is the opportunity (again with joint ventures in research, exploration, and production) to assist sister nations in the Western Hemisphere in petroleum development. Massive reserves, for example, exist in Venezuela, some of which (e.g., the heavy oils in the Orinoco Basin) can benefit from further research.

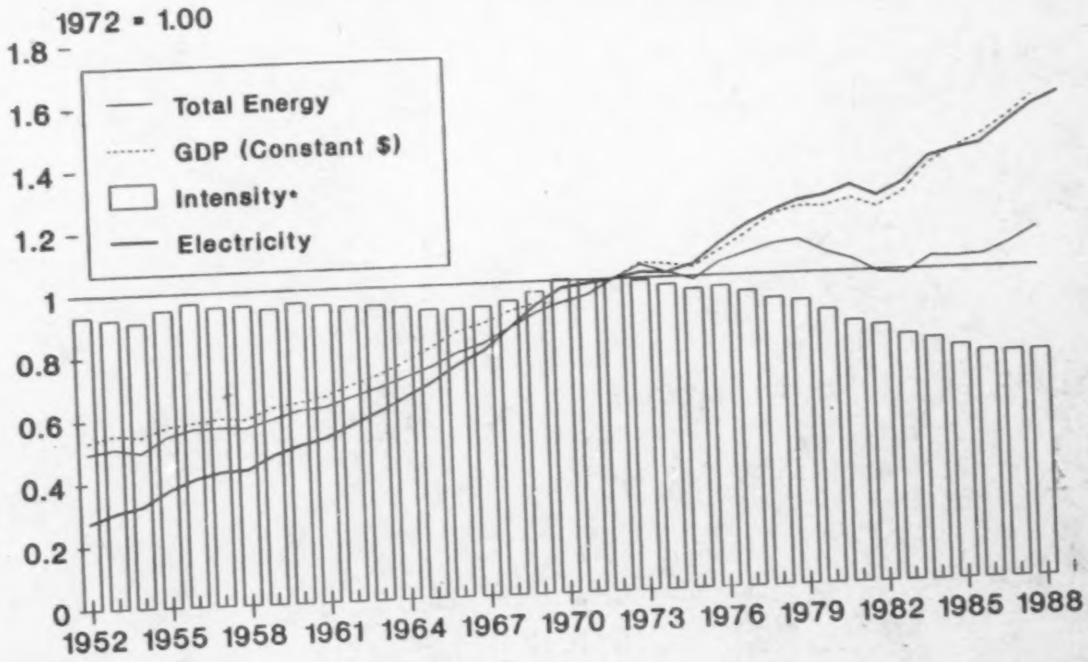
CONCLUSIONS

In addition to providing for contingencies and interruptions, we need to constrain our growing appetite for imported oil. We also need to make an explicit commitment to a smooth, multi-decade transition to the post-fossil fuel age as well as an era of constantly advancing energy efficiency. If we want accomplish such goals at minimum cost, it will take several decades from whenever we start to stabilize our dependence on imported oil, and it could take a century to get beyond fossil fuels. **Our long-term economic, environmental and national security future hangs on these transitions, and the specter of global warming could greatly foreshorten the time we once thought we could depend on fossil fuels.** The relationships among the long-term goals of economy, environment, and security I have outlined provide some important guiding principles--principles from which a systematic, integrated, and comprehensive energy strategy, which is responsive to all three goals, can logically follow.

There is an ancient Chinese saying worth repeating here: "If we do not change our direction, we are very likely to end up where we are heading." While we are still absorbing the direction proposed in the Administration's National Energy Strategy and its position on how to mitigate the agents of global climate change, we have seen little so far that gives us comfort that the need and opportunity for change is reflected in the actions proposed.

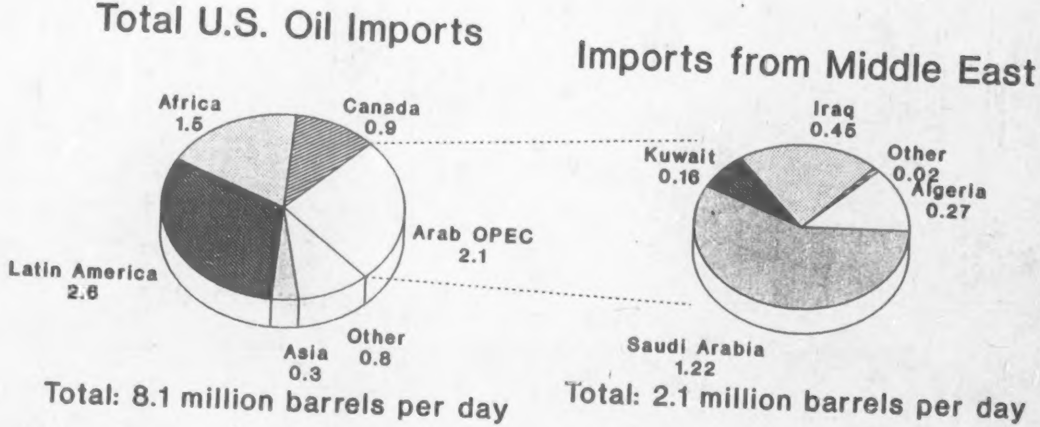
* * *

Figure 1
Index of U.S. GDP, Energy Intensity, Energy Use and Electricity Use



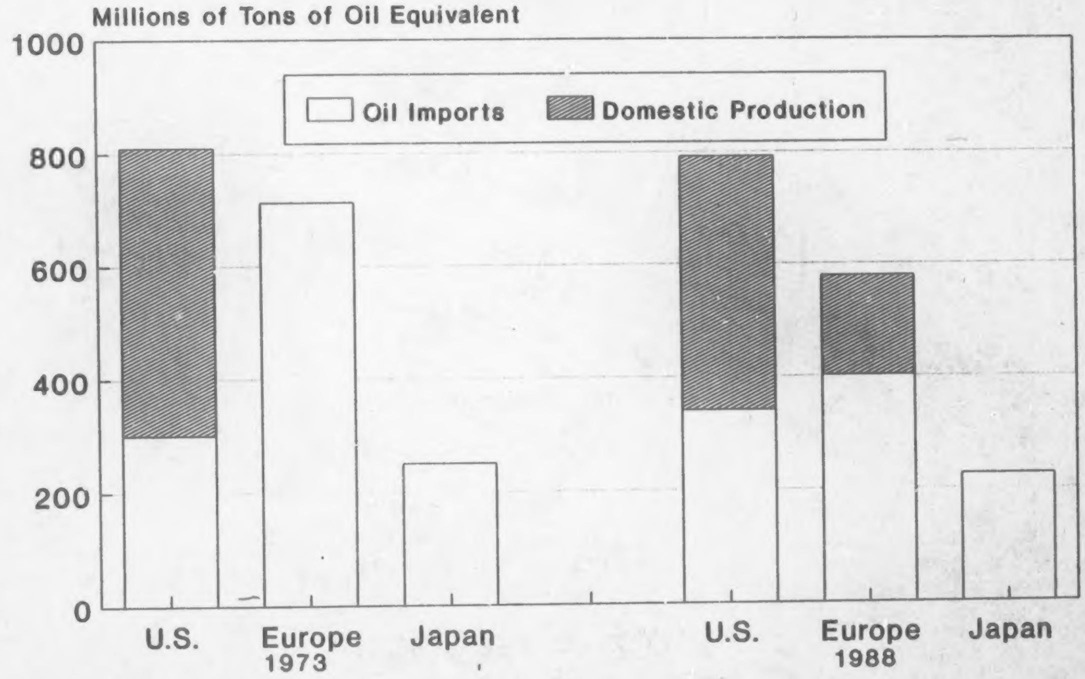
*Energy/GDP

Figure 2
U.S. Oil Imports: 1989
(millions of barrels per day)



Total U.S. Oil Consumption, 17.3 MMB/Day

Figure 3
Total Oil Use and Imports
U.S., Europe and Japan: 1973 and 1988



Source: OECD/IEA

Figure 4

U.S. Electricity Consumption

Base Case to 2020

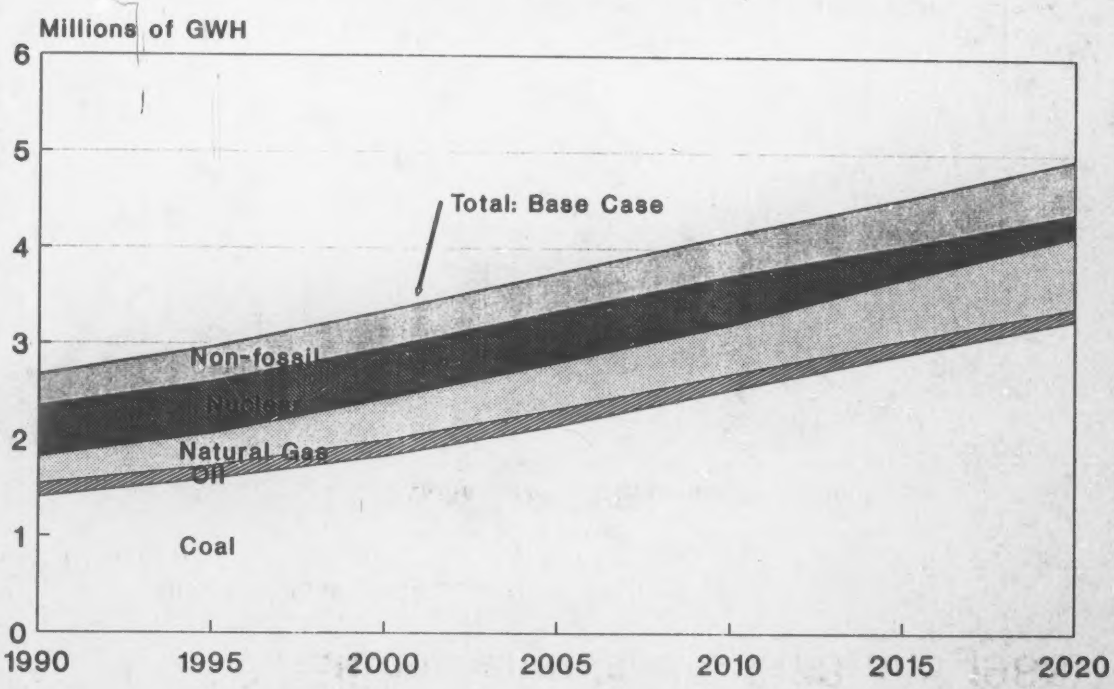
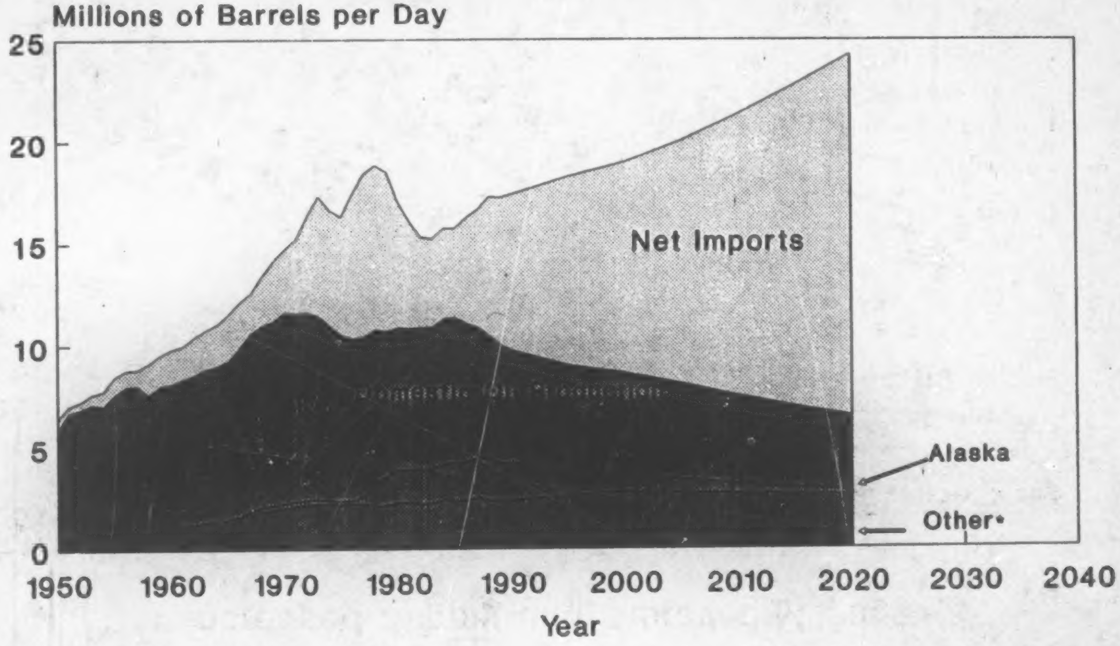


Figure 5

U.S. Oil Supply and Demand Futures

Baseline Projection



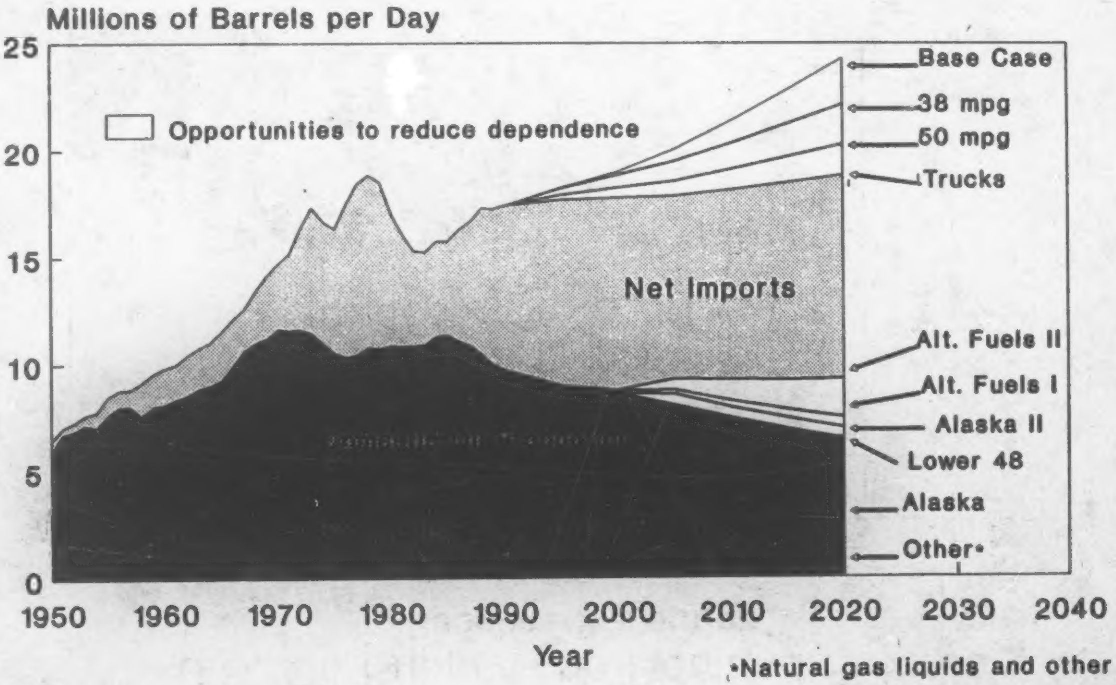
Office of Technology Assessment
Adapted from EIA, Annual Energy Outlook

•Natural gas liquids and other

Figure 6

U.S. Oil Supply and Demand Futures

Increased Supply and Improved Mileage



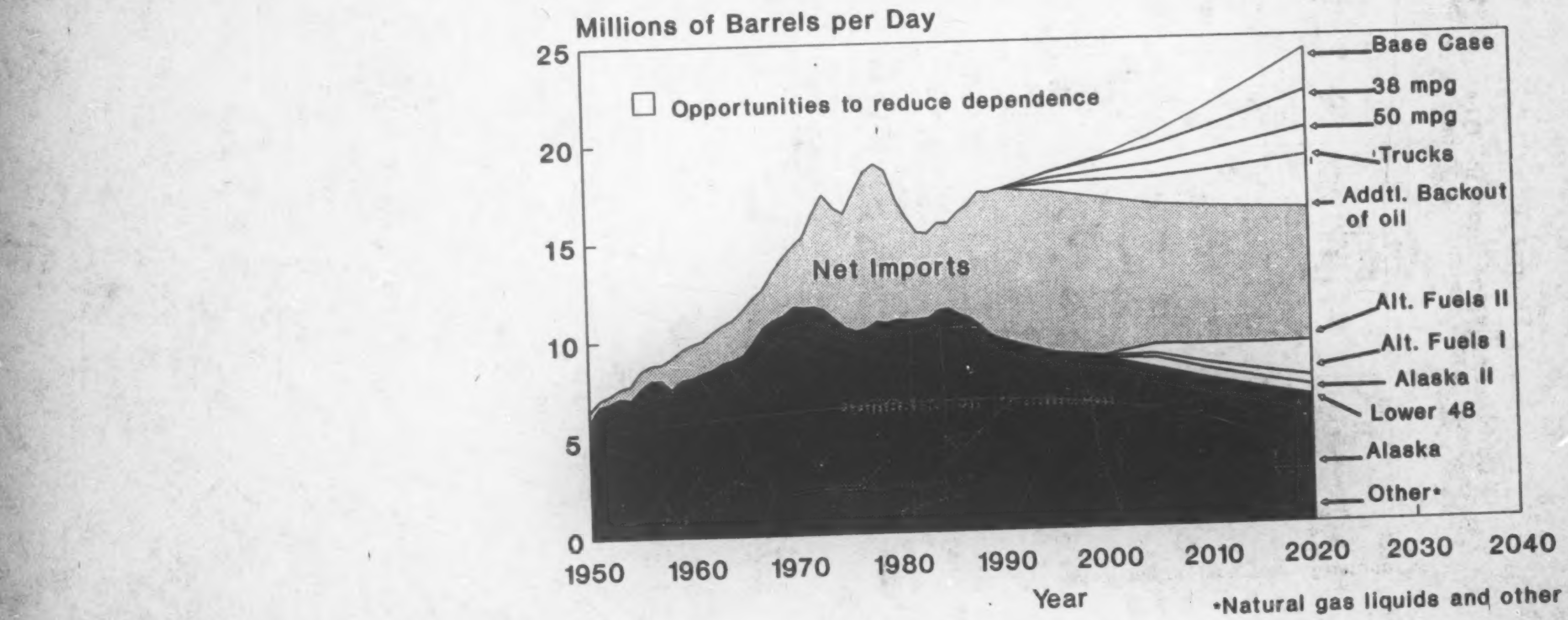
*Natural gas liquids and other

Office of Technology Assessment

Figure 7

U.S. Oil Supply and Demand Futures

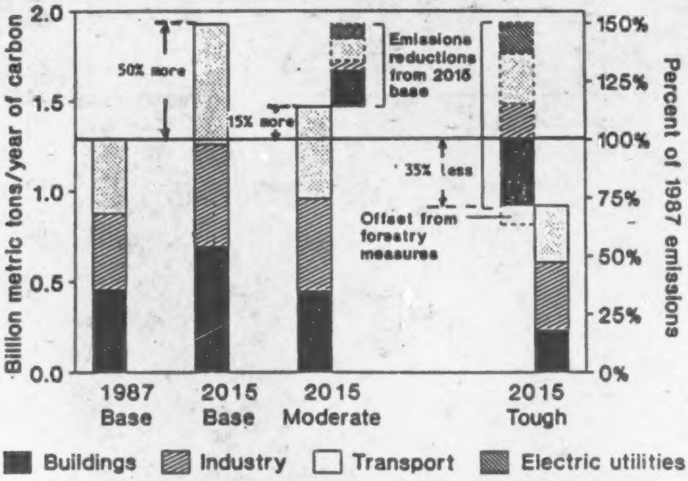
Improved Supply, Mileage, and Backout



Office of Technology Assessment

Figure 8

Carbon Emissions Under the OTA Base Case, Moderate and Tough Scenarios



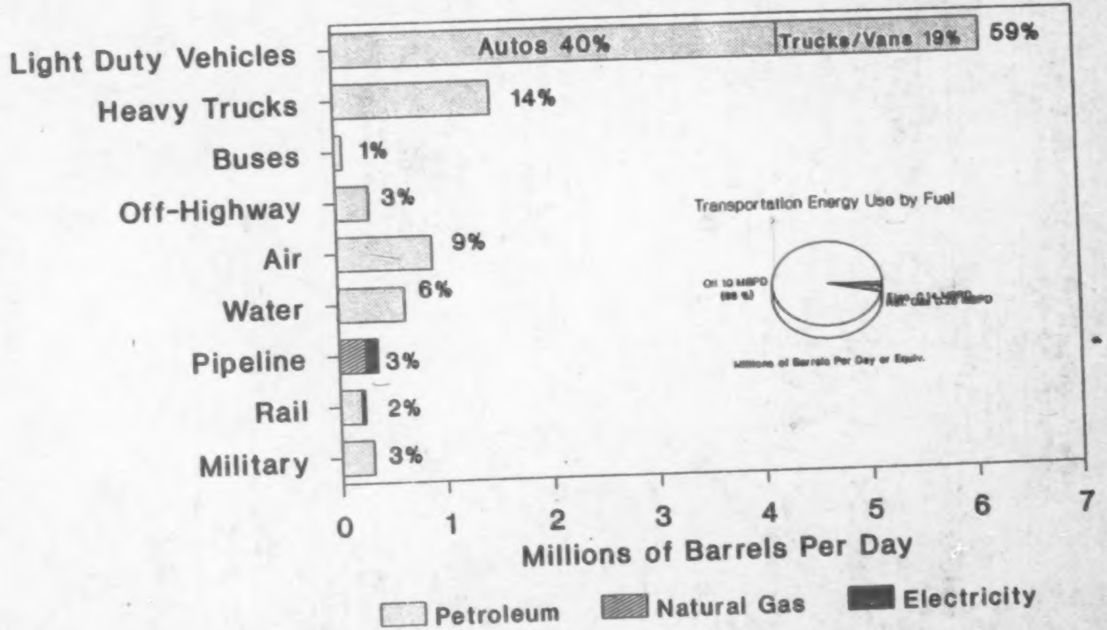
NOTE: The boxes outlined with dashed lines represent the *reductions* in carbon emissions associated with control measures applied in each of the three demand-side sectors (i.e., buildings, industry, and transportation) and electricity supply (electric utilities); additional carbon *offsets* afforded by forestry measures are also shown. The boxes outlined with solid lines represent *total emissions* from each demand-side sector. For the solid boxes, emissions associated with electricity generation have been allocated to the three demand-side sectors.

SOURCE: Office of Technology Assessment, 1991.

Figure 9

U.S. Transport Energy Use, 1987

(35 Percent of Total U.S. Energy Use)



Source: ORNL Transp. Energy Data Book

Table 1 —Measures To Lower U.S. Carbon Emissions
(expressed as percentage of 1987 total emissions)[a]

	Reductions in 2015	
	Moderate (in percent)	Tough (in percent)
DEMAND-SIDE MEASURES		
Residential buildings		
New investments:		
Shell efficiency	1.3	2.0
Heating and cooling equipment	0.1	0.4 to 0.6
Water heaters and appliances	1.2	1.5 to 2.3
O&M, retrofits:		
Shell efficiency	0.8	0.9
Lights	0.6	0.8
All residential measures together	4	5.6 to 6.6
Commercial buildings		
New investments:		
Shell efficiency	2.3	4.0
Heating and cooling equipment	1.0	1.2 to 1.9
Lights	2.1	3.0
Office equipment	1.6	2.1
Water heaters and appliances	0.1	0.1
Cogeneration	0.2	1.5 to 2.3
O&M, retrofits:		
Shell efficiency	0.8	0.8
Lights	0.5	0.5
All commercial measures together	8.5	13 to 15
Transportation		
New investments:		
New auto efficiency	0.8	3.5 to 3.8
New light truck efficiency	0.5	2.5 to 2.7
New heavy truck efficiency	0.4	2.4 to 2.4
Non-highway efficiency	0.5	1.2
O&M, retrofits:		
Improved public transit	0.2	3.5
Truck inspection & maintenance	0.3	0.4
Traffic flow improvements/ 55 mph speed limit	1.2	1.4
Ridesharing/parking controls	0.4	1.0
All transportation measures together	4	14 to 15
Industry		
New investments:		
Efficient motors	1.2	3.7 to 4.0
Lighting	0.5	0.7 to 0.8
Process change, top 4 industries	3.0	8.2
Fuel switch to gas	0.0	2.4 to 2.7
Cogeneration	0.8	5.2 to 5.8
O&M, retrofits:		
Housekeeping	1.9	2.0
Lighting	0.1	0.2
All industrial measures together	8	17 to 18
ELECTRIC UTILITY SUPPLY-SIDE MEASURES		
Existing plant measures:		
Improved nuclear utilization	4.1	4.1
Fossil efficiency improvements	1.7	1.7
Upgraded hydroelectric plants	0.5	0.5
Natural gas co-firing	—	3.7
New plant measures:		
No new coal; higher fraction of new nonfossil sources	—	0.0 to 4.7
CO_2 emission rate standards	0.4	0.0 to 0.1
All utility supply-side measures together	6.6	9.9 to 14
FORESTRY MEASURES		
Afforestation:		
Conservation Reserve Program	0.2	0.2
Urban trees	—	0.7
Additional tree planting	—	2.3
Increased timber productivity	—	3.1
Increased use of biomass fuels	—	1.2
All forestry measures together	0.2	7.5

[a] 1 percent of 1987 emissions = 13 million metric tons C = 0.7 percent of 2015 emissions.

SOURCE: Office of Technology Assessment, 1991.

Attachment

Selected OTA Reports on Energy-Related Issues

Energy in Developing Countries, January 1991.

Changing by Degrees: Steps to Reduce Greenhouse Gases, February 1991.

U.S. Vulnerability to an Oil Import Curtailment: The Oil Replacement Capability. September 1984; GPO stock #052-003-00963-3; NTIS order #PB 85-127 785/AS.

Energy Use and the U.S. Economy. June 1990; GPO stock #052-003-01195-6.

Oil Production in the Arctic National Wildlife Refuge: The Technology and the Alaskan Oil Context. February 1989; GPO stock #052-003-01131-0.

U.S. Oil Production: The Effect of Low Oil Prices. Congressional Summary, July 1987; GPO stock #052-003-01075-5; Report, September 1987.

Physical Vulnerability of Electric Systems to Natural Disasters and Sabotage. June 1990; GPO stock #052-003-01197-2.

Electric Power Wheeling and Dealing: Technological Considerations for Increasing Competition. May 1989; GPO stock #052-003-01153-1.

New Electric Power Technologies: Problems and Prospects for the 1990s. July 1985; GPO stock #052-003-01005-4; NTIS order #PB 86-121 746/AS.

Starpower: The U.S. and the International Quest for Fusion Energy. October 1987; GPO stock #052-003-01079-8.

U.S. Natural Gas Availability: Gas Supply Through the Year 2000. February 1985; GPO stock #052-003-00986-2; NTIS order #PB 86-109 162/AS.

Nuclear Power in an Age of Uncertainty. February 1984; GPO stock #052-003-00941-2; NTIS order #PB 84-183 953.

Industrial Energy Use. June 1983; GPO stock #052-003-00915-3; NTIS order #PB 83-240 606.

Industrial and Commercial Cogeneration. February 1983; NTIS order #PB 83-180 547.

Increased Automobile Fuel Efficiency and Synthetic Fuels: Alternatives for Reducing Oil Imports. September 1982; NTIS order #PB 83-126 094.

Energy Efficiency of Buildings in Cities. March 1982; NTIS order #PB 82-200 346.

Catching Our Breath: Next Steps for Reducing Urban Ozone. July 1989; GPO stock #052-003-01158-1; NTIS order #PB 90-130 451/AS.

Oil and Gas Technologies for the Arctic and Deepwater. May 1985; NTIS order #PB 86-119 948/AS.

Coping With An Oiled Sea: An Analysis of Oil Spill Response Technologies. March 1990; GPO stock #052-003-01183-2; NTIS order #BP 90-219 973.

Managing the Nation's Commercial High-Level Radioactive Waste. March 1985; NTIS order #PB 86-116 852/AS.

OTA ENERGY POLICY RELATED ASSESSMENTS IN PROGRESS

U.S. Energy Efficiency: Past Trends and Future Opportunities

The United States has achieved significant improvements in energy efficiency over the past decade-and-a half, prompting some observers to speculate that additional improvements will be much more difficult to obtain, especially in an era of relatively low energy prices. Nevertheless, many technologists argue that the potential for improved energy efficiency in virtually all sectors of the economy is far from being fully utilized. Many policy makers consider continued improvements essential as Congress faces such issues as slowing the increase in oil imports in the 1990s, improving international industrial competitiveness of U.S. goods and services, and addressing local and global environmental issues such as acid rain, urban ozone, and global warming.

As Congress addresses such issues in considering pending energy and environmental legislation and review of the Administration's ongoing formulation of a National Energy Strategy, it is important that the technological, economic, and institutional opportunities, shortfalls, and impediments associated with achieving improvements in energy efficiency be understood. This assessment focuses on the technical potential and commercial prospects for future efficiency gains. It will analyze what has promoted and deterred efficiency gains in the recent past, the research and development required to deliver new energy efficiency technologies, and alternative ways to accelerate commercial adoption of energy efficient technologies such as through efficiency standards, changes in energy pricing, or other regulatory mechanisms. The assessment will examine potential efficiency gains from the perspective of major end users: the residential and commercial sector, industry, transportation, and government, and the possible alternative roles of public and private sector involvement in promoting energy efficiency in these sectors.

In the course of this assessment OTA will draw heavily on its prior work in industrial energy use, analyzing trends in how energy use and the economy interact, examining the demand and supply outlook for energy, as well as its ongoing assessment on global climate change and extensive other studies.

New Energy Technologies and the Developing Countries

This study focuses on ways in which technology can contribute to economically and environmentally sound energy development in the world's poorer countries; and the role of U.S. policy in encouraging the rapid adoption of improved technologies. Principal questions are: do advances in technology hold the promise of providing the energy services that poor countries need for economic development, in a cost effective manner, without endangering the world or local environment? What can U.S. policy do to promote economically and environmentally sound technologies? How is the transfer of energy technology managed, and is there an opportunity here for U.S. exporters?

The study will also consider the role of developing country energy demand and greenhouse gas emissions and their relation to global warming and climate change. This assessment complements other work presently underway at OTA on policy options to reduce global greenhouse gas emissions.

Technological Risks and Opportunities for Future U.S. Energy Supply and Demand

In the first phase of the study, OTA evaluated the implications for U.S. energy policy of volatile oil prices, emphasizing the effects of low prices on domestic oil production, e.g., plugging of stripper wells and loss of production from tertiary and some secondary recovery operations in the shorter term, loss of production and reserves due to lower drilling rates, reduced R&D expenditures, and so forth in the longer term. In the second phase aimed at overall U.S. energy supply and demand, OTA is examining historic changes in U.S. energy supply and demand and the ability of previous forecasts to anticipate these changes. Next, the study will describe current forecasts for the next 15 to 25 years and identify their underlying assumptions. The study will then identify and evaluate the primary sources of technical uncertainties in the forecasts. The sources of technical uncertainty include: economic growth rates and patterns; new energy supply, conservation, and end use technologies; geologic uncertainties about available oil and gas resources; consumer reactions to lower energy prices, and other aspects of public and industry behavior; and methodological problems in forecasting. (The final report will discuss--but not extensively analyze--non-technical sources of uncertainty, primarily political uncertainty.) Finally, the study will identify and evaluate policy options that would add flexibility to the energy system, i.e., to increase the system's ability to adapt to the range of futures consistent with these uncertainties.

* * *

The CHAIRMAN. Thank you very much, Doctor Gibbons.

We will now hear from Mr. Freeman, and in looking at his biography, which I did not do justice to, I note that he has been involved in energy policy since at least the 1960s. I had recalled connecting with him during the years he served as chairman on the board of directors of the TVA, but his experience goes back even further than that to the years of the Johnson Administration and the Nixon Administration in the 1960s and 1970s, so we are happy to have you here, Mr. Freeman.

STATEMENT OF S. DAVID FREEMAN, GENERAL MANAGER, SACRAMENTO MUNICIPAL UTILITY DISTRICT, SACRAMENTO, CALIFORNIA

Mr. FREEMAN. Well, thank you, Mr. Chairman. I feel privileged to be here.

I would like to offer my statement for the record and try to summarize it as best I can if I may.

The CHAIRMAN. Without objection.

Mr. FREEMAN. I would be remiss, however, if I plunged into my testimony without acknowledging the presence of Mrs. Lloyd here, who was my strong supporter and good friend during those years at TVA. It is a delight to be before here again, as well as the Committee.

The CHAIRMAN. You may be back before her quite a bit, because we are expecting her to play the lead role in preparing the proper kind of energy plan for the country in comparison with the Administration's very good plan but not as good as it might be.

Mr. FREEMAN. Mr. Chairman, I am also delighted to be here in a role where I do not have to worry about what the Office of Management and Budget or the White House staff thinks of my testimony. That, indeed, gives me a rare opportunity to speak before this committee with the kind of candor that this committee deserves from its witnesses.

I will spare you the ancient history which is set forth in my testimony and simply comment that during the 1970s the Congress enacted dozens of laws designed to free the Nation of dependence on foreign oil, and in the 1980s virtually all of these were either killed outright or allowed to lapse by neglect during the Reagan Administration. As a result, the United States is now twice as dependent on Persian Gulf oil as it was in 1973.

Now, the theory is that there is a free market in oil. Well, the invisible hand on the pump, Mr. Chairman, is not that of Adam Smith; it is Saddam Hussein, Omar Qadaffi, the Iranians, and other nations who may be our friends today but who knows who will control them tomorrow. No one in the Executive Branch dares add up how much our imported oil really costs.

Oil consumption is also the heart of the air pollution problem in our cities, and if we keep consuming 150 billion gallons of gasoline a year on the streets and highways of our Nation, local air pollution will continue and the threat of global climate change will grow greater and greater.

So our problems of dependency on foreign oil and air pollution have one and the same cause. It is a transportation system that runs almost exclusively on oil. This Administration has spent two years exploring energy options. But, with all due respect to its so-called National energy strategy, to me it is an embarrassment. Instead of attacking the heart of the energy crisis—the imported oil—with all of our might, the Administration sends up what I can only call an energy scud. It is time to face up to the central need to find a large-scale substitute for oil empowering cars and trucks. Transportation is the one sector of our economy where oil consumption has continued increasing despite the CAFE standards and all the conservation that we have been trying to establish.

The lack of focus on developing cleaner domestic sources of energy and the technology to use them for transportation is the central failure of the Administration's so-called energy strategy.

Now, we talk about coal and nuclear power. Well, frankly, no one with any serious concern about global warming can really consider substituting coal for petroleum in our transportation sector because the coal is even richer in carbon than oil. With all due respect, the Administration's suggestion that streamlining the licensing process will restore this Nation's faith in nuclear power is laughable. It just doesn't deserve any more comment than that.

The truly large-scale substitutes for oil that meet global, environmental, and security needs are the renewables — solar power, wind, geothermal, hydro power, and, of course, the solar power can be converted to hydrogen.

I think it is useful to recognize that the oil and gas originating in the southwest and the Rocky Mountain States meet a very large proportion of our energy needs today, and I think if this committee thinks ahead and puts the kind of priorities that need to be put on our research and development effort, that 20 or 30 years from now we can replace these fossil fuels with a solar- and wind-based energy economy from the same part of our country where this energy, in the form of electricity or hydrogen, can be transported throughout this Nation again. The difference is that we will have a resource base that is domestic and essentially everlasting.

The strategy which is non-existent in the Administration's plan must therefore focus on three things: one, conservation, which has got to be done now, improving the energy efficiency, especially in the energy sector; two, really going across the goal line all the way with the solar power and the renewables and not stopping on the ten-yard line and punting as we did in 1980; and, third, retooling the American transportation energy, our cars and trucks, to run on electricity and other forms of alternative fuels.

The important point to recognize is with gasoline cheaper in real terms than it has ever been, unless these programs are advanced, and advanced by this Congress with strength and with purpose and with long-term commitment, our oil deficit will grow and grow. Some combination of stronger fuel economy standards, incentives to consumers to buy these alternative fuel vehicles, and greater long-term investment in R&D for renewables, some combination of those three are essential.

I want the record to show that I prepared this testimony before I saw Congressman Leon Panetta's bill, H.R. 560. In my view, H.R. 560 is truly a patriot. I support the bill as an excellent vehicle for making progress toward enacting a public interest energy policy.

The **Chairman**. Excuse me just a second, Mr. Freeman, while we welcome Mr. Nitze—the late Mr. Nitze.

Mr. **Nitze**. I was told 10:30.

The **Chairman**. You're not the only one. Some of the Members were told 10:30, too, but they were wrong.

[Laughter.]

The **Chairman**. We are taking up each of the panel members in order. If my schedule is correct, you are coming up right after Mr. Freeman, so you can be getting yourself in the proper frame of mind for that.

You may continue, Mr. Freeman.

Mr. **Freeman**. Yes, sir, Mr. Chairman. I will conclude in just a moment. I would just like to say two more things.

The jurisdiction of this committee can determine America's energy future. A long-term commitment to the science and technology of the points that I made—the renewables and the transportation technology to use the renewables and to move into a hydrogen economy—can make the difference. That commitment needs to be made and our research and development dollars need to reflect the priorities of this committee and the Congress.

I want to conclude by saying that the genius of American enterprise could then provide the world with what I call a new energy order, one that would reduce the threat of recession, war, and global climate change—and, incidentally, it could produce made-in-America products that would again make this country a leader in the global economy. And let no one doubt that a Nation that can produce the most accurate and deadly instruments of war can also produce alternative energy sources and electric cars, products that could enable us to get to work without going to war or polluting the air.

It is now up to the Congress to make it happen. Let's do it. Let's win the peace.

Thank you.

[The prepared statement of Mr. Freeman follows:]

TESTIMONY OF
S. DAVID FREEMAN
BEFORE THE
HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
FEBRUARY 28, 1991

Mr. Chairman and Members of the Committee:

I am most pleased to have this opportunity to testify before this Committee.

I am the former Chairman of the Board of the Tennessee Valley Authority and am presently the General Manager of the Sacramento Municipal Utility District (SMUD) a public utility which is investing a larger percent of its annual resources in conservation than any other utility in the United States. My testimony on behalf of SMUD is based on 25 years of experience with this subject.

I was the first person in the Executive Branch of the federal government with a responsibility for energy policy. President Johnson created an energy policy staff (3 people) in December of 1967 and I directed this staff working in the White House Science Office. This new effort was continued by President Nixon and I remained in that position until 1971 because both Dr. DuBridge, the Science Advisor and President Nixon were interested in developing an energy policy. Under Nixon I directed the preparation of the first Presidential energy message to the Congress in 1971. It was a beginning.

The momentum continued under President Ford. At the initiation of the Congress the fuel economy standards for automobiles were enacted into law in 1975. R & D to develop our domestic energy sources was accelerated. The objective was energy independence or at least limiting imports to a small fraction of our needs.

I assisted President Carter in developing his far reaching proposal for a national energy policy that featured conservation and the development of solar energy, wind power, and the cleaner alternatives.

President Carter gave energy policy the highest priority. He gave us a deadline of 90 days after he took office to prepare his policy proposals to the Congress. We met the deadline. He called his program "the moral equivalent of war". And in light of recent events his words seem only too prophetic.

Much of President Carter's program was enacted into law but when he left office the momentum for conservation and energy alternatives left as well. Conservation and renewables were flat out opposed by the Reagan administration. Funding for R & D was slashed. And just to make sure everyone got the point, they even took down the solar collector on the White House roof that President Carter had installed.

But the problem wasn't just neglect. The Reagan-Bush Administration had an energy policy that was quite clear. It is shocking only because it is being implemented. Unless we remember that policy because we may be doomed to continue or repeat it.

David Stockman, who later became President Reagan's Budget Director, spelled out the policy in an article in the fall 1978 issue of the Public Interest. Ironically in light of current events the article (referring to President Carter's moral equivalent of war) was entitled "The Wrong War? The Case Against a National Energy Policy."

Stockman in his article labeled the Nixon-Ford-Carter policies advocating governmental actions to obtain energy self-sufficiency to be "naive" and based on "Chicken Little" logic.

He advocated a policy of trading on the global market for oil, arguing for domestic policies which would bolster this approach--cuts in both taxes and regulations.

There was some danger of short- or long-term interruptions in the flow of oil, Stockman conceded, but to guard against these required only two policies, he said: "strategic reserves and strategic forces."

Two years later in an article entitled "Avoiding a GOP Economic Dunkirk,"-- published in The Washington Post, The New York Times, and U.S. News and World Report--Stockman provided a more detailed agenda.

He urged sweeping changes, ranging from tax cuts to what Stockman called "regulatory ventilation"--a wholesale repeal, revision or recision of energy, environmental and other rules. During the 1980's, one after another of these changes was implemented.

Tighter gas mileage standards for cars and light trucks were set aside, thus paving the way for return of gas guzzlers. Similarly, tighter tailpipe pollution standards--which indirectly increase fuel efficiency--were also blocked.

Funding for a wide variety of energy programs--ranging from conservation to renewable energy sources such as solar power were virtually eliminated. The program to develop domestic sources of synthetic fuels such as oil shale and coal liquefaction was killed and the projects canceled.

During the 1970's, the Congress enacted dozens of laws designed to free the nation of dependence on foreign oil. Then in the 1980's, virtually all of these were killed outright or allowed to lapse by neglect. All that kept a few alive--small scale funding of conservation and solar, for example--was the Congress. But those were the exception rather than the rule.

As a result, the United States is now twice as dependent on Persian oil as it was in 1973.

This would not necessarily be a bad state of affairs if the world supply of energy were really a free market. But it isn't. Oil is controlled by a cartel, some of whose members support terrorism and others of whom wage a "holy war" against the United States. The invisible hand on the pump is not that of Adam Smith--it's Saddam Hussein, Moammar Gradhafi, the Iranians and other nations who are friends today but who knows who will control them tomorrow.

Recent events have again brought us a painful reminder of just how wrong-headed this reckless reliance on oil imports has been. No one in the executive branch dares add up how much our imported oil really costs. Depending on how much of our defense budget and the war effort you attribute to the need to keep Middle Eastern oil out of the hands of our current enemies the number could be as high as $50 to $100 per barrel. And this doesn't include the impact on the economy of oil price shocks and recessions or even the cost of the pollution created when oil is burned so wastefully. Nor can any numbers reflect the value of human lives lost in protecting America's oil lifeline.

Oil consumption is also the heart of the air pollution problem in our cities. We enact "Clean Air Laws" but there will be no clean air as long as we burn 150 billion gallons of gasoline on the streets and highways of our nation every year. And if we keep consuming this much oil the threat of global climate change will grow greater and greater.

So our problems from the dependency on foreign oil and air pollution have one and the same cause--a transportation system that runs almost exclusively on oil.

Surely, the Congress will agree with Presidents Nixon, Ford and Carter that we need a policy of energy self-sufficiency.

That brings me to my major point. This Administration has spent two years exploring energy options. But with all due respect its so called National Energy Strategy is an embarrassment.

What the Administration has sent to the Congress is not a coherent energy policy proposal to deal with the essence of the crisis--imported oil. It is a collection of rabbit trails to satisfy special interests--the oil, nuclear and automobile lobbys and others.

What is lacking are proposals that assert the broad public interest. And I say this more in sorrow than anger because the President is preoccupied with a war and the proposals reflect not what Admiral Watkins heard from the American people but rather what a few people in the White House think, people who share the wrong-headed thinking of the Reagan-Bush Administration.

Instead of attacking the heart of the energy crisis with all our might the Administration sends up an energy scud.

Yet if America is to win some peace, we must finally go for the jugular. We must balance our energy budget by eliminating the dependence on oil imports in this decade and eliminating our heavy use of oil early in the next country. And it can be done without pain or sacrifice. All it requires is leadership to make a change for the better.

It's time to face up to the central need to find a large-scale substitute for oil in powering cars and trucks. And it's time to learn from experience. Since the 1973-74 crisis, national fuel economy standards did improve the gasoline mileage of cars. The savings were large and without better mileage cars we would be importing even more oil. But the savings from better mileage cars since 1974 have been more than offset by the increased numbers of vehicles on the road and the fact they are driven more and more miles because gasoline is cheap. Thus transportation is the one sector of our economy where oil consumption has continued increasing.

Meanwhile, despite higher prices, domestic oil production has gone steadily downward since 1970. Even the giant Prudhoe Bay oil field in Alaska was started and has already peaked out between crises. America is an old oil patch. Drilling in environmentally sensitive locations such as offshore California or the Alaska Wildlife Refuge will not solve our problem. After 20 years of trying can't we accept the fact that oil production in the U.S. oil can't possibly keep up with runaway consumption.

Greater efficiency can reduce oil consumption much like we reduce the deficit--it can prevent it from increasing so fast. Production incentives such as a floor on oil prices could slow the rate of domestic production decline. But without alternative, cleaner, domestic fuels "to get to work" and to "joy ride" we will continue to import huge quantities of oil. And we will continue to have more of our cities as "non-attainment" areas--that is poor air quality--and the CO2 menace will grow.

Conservation is essential but insufficient. A floor on oil prices will help a whole lot more than drilling in sensitive environmental areas. But it will only slow the decline.

Alternative energy sources to substitute for the "gasoline tank" are crucial if we are to reduce--and over time eliminate--the problems oil is now causing the world.

The lack of focus on developing cleaner sources of energy and the technology to use them for transportation is the major failure in our energy strategy.

First of all, the nation today has no technology to use coal or nuclear power to substitute for gasoline. Coal and nuclear make electricity but American industry has yet to get electric cars on the road, even though the U.S. Government put one on the moon twenty years ago.

But neither coal or nuclear power are the answer. No one with any concern about global warming would consider coal, which is even "richer" in carbon than oil, to be the alternative to oil for transportation. And before there is a market for more nuclear power, the nation must put in place a solution to its waste disposal "backlog" and develop safer more economical designs. These are but two ingredients of resorting public trust in nuclear which has been lost since Three-Mile Island and Chernobyl.

The Administration suggestion that steamlining the licensing process will restore faith in nuclear power is laughable to this utility executive who has had a great deal of experience with nuclear power.

Natural gas supplies a large market today and it can play a limited role in substituting for oil in vehicle fleets and perhaps in individual automobiles, especially if converted to methanol. But natural gas does not represent a truly large scale substitute for oil without importing the natural gas from overseas and this would raise many of the same national security problems caused by oil. And natural gas also adds to the CO2 build-up and to air pollution albeit to a lesser extent than oil.

Biomass too can be converted to automotive fuels such as ethanol that are much cleaner than oil. They constitute an important but relatively small scale substitute without robbing the food supply or clear-cutting forests. And let us not forget that "reformed" gasoline still comes from crude oil that must be imported. And it still pollutes the air and adds to the build-up of CO2.

The truly large scale substitutes for oil that meet global environmental and security needs are the renewables--solar power, wind, geothermal, and hydropower.

That means that the cleaner renewables must be developed with a great sense of urgency. Solar technology has progressed for generating electricity in both large plants and with photovoltaic cells. New wind turbines are nearly competitive. These new sources need the attention given to going to the moon in the 1960's. In the 90's our goal needs to be harnessing the sun and the wind here on earth.

Large scale solar power can of course charge batteries for electric vehicles. And the electricity can be converted to hydrogen which in turn could provide a truly clean source of fuel for motor vehicles (perhaps in small fuel cells) as well as homes and commercial establishments.

The oil and gas originating in the Southwest and Rocky Mountains meet much of America's energy needs. They can be replaced with solar and wind power either as electricity or in the form of hydrogen that can also be transported vast distances.

Developing renewables is essential but it too is only one of the necessary steps in a strong energy plan. America's energy plan must include retooling America's transportation industry so it can run largely on electricity, natural gas, fuel from biomass and, in the future, perhaps hydrogen from solar power.

With the electric vehicles on the road, solar power and other renewables will then be able to replace oil. The strategy must therefore focus on:

(1) Conservation--improving energy efficiency especially in transportation

(2) Commercializing solar power and other renewables

(3) Retooling cars and trucks to run on electricity and other forms of these alternative fuels.

There are numerous policy choices for achieving these goals.

The important point is to recognize that with gasoline cheaper than ever in real terms, unless these programs are advanced by a strong government energy plan, our oil deficit will grow.

Governmental intervention in the market through regulation or taxation and R & D is thus essential to reflect the tragic cost of oil imports and the threat of global warming.

A large gasoline tax (as it now exists in every nation in Europe) appears politically impossible, even though advancing it as a tax reform rather than a new tax should be attempted. Reducing income taxes for middle income citizens and raising the money from a tax on gasoline would be a major advance.

But being realistic, some combination of stronger fuel economy standards, incentives to purchase alternative fuel vehicles and greater investment in R & D for renewables is essential.

The renewable resources and electric cars and trucks that can utilize this cleaner domestic energy offer a superior value to society. They need "a push" to achieve the economics of large scale production and product improvement. In short they need help--some would call it subsidy--to become commercial just as oil and nuclear were and are still being subsidized. The sums required are not tens of billions but more modest sums that should be available in the federal budget of over 1.4 trillion dollars.

These "clean energy technologies" are all well beyond the laboratory but are not yet commercial. Incentives to consumers (or subsidies if you please) to make solar power, other renewables, and electric cars competitive are needed. A long term commitment by the federal government to advance solar, hydrogen and other clean energy technology is essential. Energy R & D has been cut on and off like a neon sign. If we are to achieve the twin goals of national security and environmental sanity then we can't afford to stop until these clean energy technologies are commercial.

I want the record to show that I reached this point in the preparation of my testimony before I received a copy of H.R. 560 introduced by Congressman Leon Panetta.

H.R. 560 is truly "a patriot." It provides the essential ingredients of a national energy strategy. I support the bill as an excellent vehicle for making progress toward enacting a public interest energy policy. In fact, in addition to dealing with the essence of the problem I've been discussing, it touches on the other subjects I wanted to mention namely:

(1) Enlarging the Strategic Petroleum Reserve is a must. This

Administration stopped short of the goal we set in 1977.

(2) The need to emphasize conservation in the use of all forms of energy usage because there is a shortage of relatively clean power. And conservation is not only the lowest cost but the cleanest possible source since it means avoiding waste. And as H.R. 560 provides, there is a leadership role for the federal government which is vital.

(3) The elimination of the tax on conservation incentives is a matter of vital importance. It is frustrating to SMUD as a utility advancing conservation to face a disincentive in the federal tax law, these tax rebates for conservation while rebates for gas guzzlers by automobile companies remain tax free.

Let me conclude by stressing that the solution to this energy crisis namely switching from oil to cleaner domestic fuels-can also provide the answer to other major challenges facing this nation. Really achieving clean air is an obvious benefit. But the opportunities go deeper. We can develop motor vehicles and renewable energy technology that would be admired and, more importantly, purchased throughout the world.

If we went for the jugular, the genius of American enterprise could provide the world with a "new energy order", one that would reduce the threat of recession, war, and global climate change. And incidentally it could produce the "Made in America" products that would again make America a leading light in the global economy.

And let no one doubt that a nation that can produce the most accurate and deadly instruments of war can also produce alternative energy sources and electric cars. Products enable us to get to work without going to war or polluting the air. It's now up to the Congress to make it happen. Let's do it. Let's win the peace.

The CHAIRMAN. Thank you very much, Mr. Freeman.

If you are ready now, Mr. Nitze, we'd be glad to hear from you. We are trying to get through all of the panelists, and then we will have questions from members of the committee.

STATEMENT OF WILLIAM NITZE, PRESIDENT, ALLIANCE TO SAVE ENERGY, WASHINGTON, D.C.

Mr. NITZE. Thank you, Mr. Chairman. My apologies again for arriving a little late.

It is a privilege to testify before this committee on behalf of the Alliance to Save Energy, of which I am president. The Alliance is a coalition of business, government, consumer, and environmental leaders devoted to the cause of energy efficiency and conservation.

We strongly support the initiatives which are contained in H.R. 560 and believe that those initiatives fill a major gap in the national energy strategy proposal which has been put forward by the Administration.

In particular, they deal with the very important issue of oil use in our transportation sector which, in our view, is not adequately addressed in the Administration plan.

The Administration plan does contain a limited number of efficiency initiatives, including some initiatives to encourage the use of non-oil-based fuels in the transportation sector, including an extension of the Clean Air Act requirements with respect to fleets and including research and development and other measures such as lifting the CAFE cap on dual-fueled vehicles to encourage the use of alternative fuels.

But beyond those rather limited initiatives, and beyond a number of research and development items with respect to new types of vehicles, new types of public transportation systems, there is really nothing in the Administration's package which would have a significant impact on our use of oil in the transportation sector over the next ten years. And obviously H.R. 560 attempts to address that gap by proposing significant increases in corporate fuel economy standards for automobiles by extending them to light trucks and by building in a floor-price ratchet system for increasing the price of petroleum and petroleum products. We very much support those initiatives. We would even encourage you, with respect to the taxation portions of the bill, to go further.

Finally, we strongly support increased research and development funding with respect to energy efficiency, new energy technologies, and renewable fuels. Again, one of the disappointing things about the Administration's package is, although there are a number of very interesting research and development ideas in the package, we are unable to find, either in the package or in the 1992 budget, any significant funding to really get those initiatives really moving forward.

There are a number of areas which I refer to in my testimony which we think should be added to the measures included in H.R. 560 to come up with a comprehensive energy efficiency package. The most important are in the buildings area where we think the Federal Government can do considerably more to encourage integrated resource planning and demand-side management by using cheap power from Federal power marketing authorities, approval of inter-state power sales, VHA loans, and other Federal levers to encourage States to do least-cost planning. We believe that there is considerably more that can be done with respect to the equipment in buildings through codes and appliance standards. We think that the Federal Government should go much further than it has in extending standards to new categories of products and in tightening standards that already exist.

And we believe that there are things that can be done with industry to encourage American industry to continue and even accelerate its excellent historical record in improving energy efficiency. This would include joint R&D, which, again, I think you are proposing to fund. It would include setting up a network of centers where individual companies could work with government at all levels in coming up with energy efficiency initiatives.

So basically, to try and conclude, in my initial testimony I would say that H.R. 560 is an excellent start, but if we are to have a comprehensive package we need to include some other elements that relate not just to the transportation sector but to the buildings and industrial sectors and to the whole area of energy education. But I do believe that the Congress and the House—and this committee, in particular — have a leadership role to play in this area. I am, frankly, disappointed that the Administration's proposal did not go further.

We at the Alliance look forward to working with Congress in helping to put together a cost effective energy plan which exploits our relatively low-cost energy efficiency opportunities first.

Thank you.

[The prepared statement of Mr. Nitze follows:]

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Testimony of William A. Nitze
President of the Alliance to Save Energy
Before the Committee on Science, Space and Technology
U.S. House of Representatives
February 28, 1991

Mr. Chairman, Members of the Committee, Ladies and Gentlemen:

My name is William Nitze and I am President of the Alliance to Save Energy. I appreciate the invitation to testify before the Committee on the Administration's proposal for a National Energy Strategy and on H.R. 560, the National Energy Policy Act of 1991, sponsored by Congressman Panetta. The Alliance to Save Energy is a national nonprofit coalition of government, business, environmental and consumer leaders dedicated to increasing energy efficiency. We conduct research, pilot projects, educational programs and policy advocacy to achieve this goal.

1. The Alliance's Basic Philosophy and Approach

The Alliance first seeks to identify specific energy saving opportunities in the residential, commercial, industrial and transportation sectors of our economy. We then develop policies and techniques for exploiting those opportunities in the most cost-effective manner. Our primary goal is to help provide whatever level of energy services is required by the U.S. economy with a smaller input of primary energy. Our secondary goal is to help develop a wider menu of cost-effective, less carbon-intensive energy sources.

Achievement of these goals will serve a number of national objectives simultaneously. By using less energy to produce the same level of energy services, we will have more money to spend on other priorities. By reducing pollution from energy related sources, we will improve environmental quality locally and globally. By lowering homeowners' energy bills, we will make housing more affordable. By making U.S. goods and services more energy efficient, we will enhance our international competitiveness.

The key to developing a cost-effective national energy strategy which promotes energy efficiency and more environmentally benign supply options is least-cost planning. We must first incorporate environmental and national security impacts into our analysis of the costs and benefits of various policy options. This analysis will enable us to rank the various options for providing energy services inversely to their cost per unit of energy service provided. We will then be in a position to select the least-cost package of options to provide any given level of energy services.

2. Overview of the Administration's NES Proposal

The Administration's NES proposal acknowledges the need for greater energy efficiency, less vulnerability to disruptions in foreign energy supplies, and more environmental sustainability. It also recognizes the need to incorporate environmental externalities into the analysis of the costs and benefits of different policy options. Finally, it stresses the need to achieve our energy security and environmental goals at the lowest possible cost.

Unfortunately the Administration then proceeds almost entirely to disregard these principles in its actual choice of policy proposals. Many analyses of U.S. energy policy options, including the recent Office of Technology Policy Report Changing by Degrees, conclude that energy efficiency improvements are the lowest-cost options for meeting our energy security and environmental goals. A number of studies, including a recent consultant's report prepared for the Administration itself, identify a number of energy efficiency improvements that actually reduce costs without even taking environmental externalities into account. Yet almost all of the substantive policy options put forward by the Administration are designed to increase energy supply. The Administration proposes to open up the Alaska Coastal Plain to oil exploration, expedite gas pipeline construction, and reform the nuclear power licensing process. There are no equivalent proposals for reducing energy demand.

Almost all of the energy efficiency initiatives are phrased in terms such as "allow," "encourage," "review," or "provide assistance." For the most part these initiatives are merely continuations of what the Administration is already doing and do not show any real commitment to change. For example, the Administration pledges to "continue to provide assistance" for weatherization and other state energy programs, but all but zeros out funding for these programs in its FY92 budget request.

The two initiatives that directly promote energy efficiency -- providing tax-free treatment of utility efficiency discounts and requiring energy-efficiency labeling -- are merely watered-down versions of the utility rebate tax exemption and lighting efficiency standards initiatives proposed by the Department of Energy (DOE) and rejected by the White House. The Administration lists a number of R&D initiatives to develop new energy technologies, but does not indicate how those initiatives might be funded.

The most serious overall deficiency in the Administration proposal is that it would do little to reduce U.S. oil consumption and specifically our reliance on imported oil. The transportation sector accounts for almost 11 million barrels a day of oil or approximately 63 percent of total U.S. oil consumption. Therefore we must reduce our use of oil for transportation if we are to make a serious dent in U.S. oil imports.

There are four basic options for reducing oil use in the transportation sector: (1) increasing taxes on gasoline and other oil based transportation fuels; (2) requiring vehicle manufacturers to make their products more fuel efficient by increasing fuel efficiency standards; (3) providing a point of purchase incentive for people to buy more fuel efficient vehicles; and (4) improving public transportation. None of these options is included in the Administration's proposal.

The Administration does seek to encourage increased use of alternative fuels by extending the Clean Air Act Amendment requirements for fleets to the whole country and by removing the Corporate Average Fuel Efficiency (CAFE) cap for dual fuel vehicles. The first of these initiatives is unlikely to have much short-term impact on oil consumption. The second may actually increase it by encouraging production of less efficient dual fuel vehicles which run primarily on gasoline.

Finally, there are a number of research initiatives targeted at new energy and public transportation technologies in the Administration package. Unfortunately most of these merely represent continuation of existing programs and have not been assigned increased funding. None is likely to have a significant impact on U.S. oil consumption before the year 2000.

3. H.R. 560, the National Energy Policy Act of 1991

H.R. 560, the National Energy Policy Act of 1991, sponsored by Congressman Panetta, directly addresses fuel efficiency in the transportation sector and increased funding for research and development for energy conservation, new energy technologies, and alternative energy sources, two of the critical areas neglected in the Administration proposal.

With respect to fuel efficiency, the bill requires each manufacturer to increase CAFE standards for passenger automobiles and light trucks by 20 percent starting in model year 1996 and 40 percent starting in model year 2001. The bill also increases import duties on crude petroleum and petroleum products and Federal excise taxes on gasoline to the extent necessary to offset price declines below base prices reflecting current price levels.

With respect to research and development, the bill authorizes substantial increases in funding levels for energy conservation research, solar and alternative energy, enhanced oil recovery research, fuel cell research and development, and alternative fuel vehicles.

The Alliance to Save Energy supports all of these initiatives. We believe that the fuel efficiency standards proposed in the bill are achievable with existing technologies. We strongly support extension of CAFE standards to light trucks, which constitute a growing portion of the overall vehicle fleet. We also support gradual increases in Federal taxes on gasoline and other transportation fuels to encourage fuel efficiency. We believe the bill could go somewhat further in this direction by providing for gradual tax increases even if the floor prices established by the bill are exceeded. Finally, we support increased multi-year Federal funding for R&D on energy efficiency, new energy technologies and alternative fuels. We believe such research funding should be linked to parallel funding by private sector institutions. Dissemination of the results of this research should be facilitated through a substantial expansion of the Energy Analysis and Diagnostic Centers Program, now operated at a pilot level.

4. Other Energy Efficiency Options Not Included in H.R. 560

We do not offer any specific comments on those portions of the bill not directly related to energy efficiency, except to express general support for measures to promote the use of non-oil based fuels. We would like to take this opportunity, however, to discuss a number of energy efficiency policy options supported by the Alliance that should be part of any comprehensive energy bill, but are not included in H.R. 560 as currently drafted. These options are as follows:

(a) Federal Energy Management

The Federal government is not only the nation's largest energy consumer, but also is the nation's largest energy waster. In 1989, Federal agencies spent almost $3.5 billion to heat, cool and power buildings, $174 million more than they should have according to the goals outlined in recent Federal legislation. Prior to 1985 Federal building energy use per square foot was reduced by a total of 17 percent. Despite a 1985 law establishing a further 10 percent reduction goal by 1995, however, this trend has been reversed with energy use per square foot increasing by 1.1 percent in 1989.

The principal reason for this reversal is not hard to find. Federal spending on energy efficiency improvements has declined from $256 million in 1985 to $45 million in 1989. At this level the Federal government is investing less than $90 on energy efficiency improvements in an average Federal building costing almost $7000 per year to heat, cool and power. U.S. manufacturers offer a wide range of cost-effective energy efficient products that can lower energy costs without sacrificing productivity or personal comfort. The Alliance to Save Energy estimates that the Federal government could save taxpayers $864 million per year or almost one quarter of the Federal energy bill if it exploited the efficiency opportunities with a payback of 10 years or less presented by these products.

A number of changes must be made in Federal energy management to accomplish this objective, including better leadership, goals and enforcement. There are at least two specific changes that should be included in a comprehensive energy bill. The first is to create a Federal Energy Efficiency Fund in DOE coupled with a requirement that agencies request money in their budgets for energy efficiency projects. This fund should receive an annual appropriation of at least $300 million that would be disbursed for qualifying projects over and above agencies' regular budgets. The second is to create incentives for facilities and energy managers. Individual Federal facilities should be allowed to retain two-thirds of the energy cost savings from conservation projects. In addition, energy managers that do an outstanding job should be rewarded with a cash bonus.

(b) Use of Federal Levers to Encourage Integrated Resource Planning by Utilities

Utilities in California, New England and other parts of the country have instituted integrated resource planning (IRP) programs which have already eliminated the need for significant capacity additions. It is important to realize the potential of IRP to stimulate cost effective energy efficiency investments by utilities in their customers' facilities in other states as well. The Federal government has an important role to play in this process by using "Federal levers" to encourage utilities and regulatory commissions to work together in preparing integrated resource plans. The Administration's NES proposal speaks of promoting IRP through Federal power marketing administrations and FERC regulation of interstate power sales, but stops short of proposing that Federal power marketing administration sales or FERC approval of interstate power sales be made conditional on consideration of IRP.

A comprehensive energy strategy bill should provide for using these two levers to encourage IRP. Sales of cheap Federal power from Federal power marketing authorities and approval of interstate power sales should be made expressly conditional on the purchaser's or applicant's preparation of an integrated resource plan or at least an explanation of why such a plan cannot be prepared. In addition, the tax exemption for utility rebates deleted from the Administration's NES proposal must be reinstated.

(c) Buildings

Buildings account for more than a third of the energy used in this country. Alliance research and review of related work shows that at least 25 percent of this energy can be saved cost-effectively. However, buildings are one of the hardest sectors to reach, because of their numbers (nearly 100 million) and because of the fragmented nature and regulation of the building industry. There are about 100,000 builders in the U.S., most of them small businesses. They operate within a labyrinth of state and local building code requirements that resist rational inclusion of energy standards. There are also market barriers such as the builder/buyer obstacle where the builder is reluctant to invest in added efficiency features when the benefits will flow to the buyer, and the landlord/tenant problem where apartment owners are hesitant to pay for energy improvements for tenants' benefit.

To achieve the energy efficiency potential of the buildings sector, a sound national energy policy should include:

- a Federal requirement that states upgrade their building energy codes to modern standards or face the loss of Federal mortgage assistance programs;
- a program for linking energy efficient mortgages to home energy ratings to encourage builders to go beyond code requirements and to allow buyers of existing homes to pay for energy improvements through their mortgages;
- the improvements in Federal energy management discussed above; and
- increased funding of the Federal Weatherization Assistance and Institutional Conservation Programs.

(d) Appliances

As buildings-oriented policies increase the thermal efficiency of the structure -- and significant gains have occurred in the last 15 years -- the appliances and other energy-using equipment inside account for a growing share of the total energy used in the building. The primary means for increasing the efficiency of these appliances and other equipment is energy efficiency standards. Indeed the appliance labelling and standards programs established in the last 15 years have already resulted in substantial increases in the efficiency of these products.

It is now time both to increase the stringency and to extend the coverage of efficiency standards for energy-using appliances. The Federal government should review the full range of residential and commercial appliances and develop standards for additional appliances whose efficiency can be increased cost-effectively. At a minimum, standards should be developed for electric lamps, packaged commercial heating and cooling equipment, and electric motors. The Federal government should also revisit standards it is now setting for residential appliances and investigate cost-effective options for raising them.

(e) Trade

Improved information about world markets for energy efficient products is critical if U.S. manufacturers are to keep up with foreign competitors and increase their share of world markets for the next generation of energy efficient technologies and equipment. The CORRECT program should be expanded to provide this information. The Secretary of Energy should also be required to report to Congress every other year on the energy efficiency programs of our major foreign competitors, specifying their R&D funding levels and priorities, and evaluating the assistance they are providing to their own manufacturers.

5. Conclusion

H.R. 560 represents a major step forward from the Administration's NES proposal in creating the foundation for a comprehensive energy strategy that serves the nation's economic, environmental, social and national security objectives. It needs to be expanded, however, to incorporate additional cost-effective policy options that will help us achieve those objectives. The United States has the potential to achieve significant improvements in its energy efficiency at little or no cost, but it will take real legislative commitment to realize this potential.

The CHAIRMAN. Thank you very much, Mr. Nitze.

Our next panelist is the Honorable Mark Singel, Lieutenant Governor of the State of Pennsylvania. I might say if the job of lieutenant governor in Pennsylvania is like it is in California, we assign the lieutenant governor all of the difficult but highly-important jobs that need to be done and hope that he can do a better job than the governor does on these things, and we assume that Mr. Singel has had some of that same experience.

STATEMENT OF MARK SINGEL, LIEUTENANT GOVERNOR, STATE OF PENNSYLVANIA, HARRISBURG, PENNSYLVANIA

Mr. SINGEL. Thank you, Mr. Chairman. I'm afraid I can't comment on the relationship between California and Pennsylvania's lieutenant governor.

The CHAIRMAN. We don't expect you to.

Mr. SINGEL. But what I do want to say is that I am honored that you invited me to offer a few comments here, and particularly pleased to be on the same panel with some obviously very distinguished experts in the energy field. Like them, I would like to offer my written testimony for the record and summarize for you.

The CHAIRMAN. Without objection that will be the order.

Mr. SINGEL. Do that not only because the written testimony is overly lengthy, but also because much of it would be repetitive. I would like to associate myself with the comments made by the three presenters. I agree very strongly with their focus and their direction. I think it is a much more appropriate direction for the National energy policy to take.

Let me also begin by thanking in absentia the two distinguished members of the committee from Pennsylvania, Congressman Walker and Congressman Ritter, whose service on this committee we are grateful for in Pennsylvania, and also take a moment to single out your staff assistant Frank Murry, who happens to come from Philadelphia and has helped us in various energy matters throughout the year.

I am the lieutenant governor of the Commonwealth of Pennsylvania, and one thing that I do have responsibility for is our own State policy. I have had the opportunity to be involved in the development and initiation of what we feel is a long-term policy for energy development and energy efficiency and the various topics that we are addressing today at the State level. I'd like to share some of those initiatives with you.

First, let me agree and align myself with those who say that the development of a National energy policy and an energy that focuses on conservation and efficiency and represents a balance of all potential sources of energy is vitally important from a State's perspective. We can experiment on the State level, we can innovate, and we can test various programs, but what we cannot do is put together the overall National focus that is sure to bring together the need to address both energy and environmental concerns. That must be done at the Federal level.

While we are pleased that the Federal Government at long last has put forth a strategy, we are very much concerned that it misses the mark and that it dramatically under-emphasizes the aspects of conservation and efficiency, which is, as has already been stated, the single-most important potential source of new energy for all of the States.

The National energy policy could be an effective tool in many regards. It could send a strong message to the marketplace about trends in future energy development, it could send a legislative agenda to be addressed at the Federal level like the CAFE standards or Federal tax incentives or disincentives for energy use and production, and it could be a vehicle to encourage a National awareness about the importance of energy efficiency.

Unfortunately, it is our impression that the National energy strategy proposed by the President in the last several days does not go far enough. In fact, I will go so far as to say that it shows a virtual disregard for any long-term, meaningful policy concerning production and consumption. It does not lead us in the direction of sound, economically viable, and an independent energy future, and it shows all of the markings of taking us further into the abyss of further dependence on foreign oil. I think that is unfortunate, but it is not uncorrectable. I think the legislation that you are considering today—some of the initiatives that have been put forth by Members of Congress have already begun to move in a positive direction, and we are hopeful that that continues.

From a State perspective, what we are suggesting is much like what has already been proposed today: that we balance the policy; that the National energy strategy should seek to secure an affordable, long-term energy supply, but should recognize that energy efficiency and conservation is the key initiative, is the key direction that could assure that.

I believe that a cost/benefit analysis should be applied with regard to the long-term cost of each option in terms of taxes, consumer energy bills, environmental impact, security risk, and those should be weighed against the energy that we expect to generate. I also believe that it is extremely important that the National energy strategy be balanced. While there are some very productive production-oriented portions of the National energy strategy, again I would say that the efficiency and conservation are equally important and should be emphasized.

Let me shift to Pennsylvania just very briefly, so I don't take up too much more of your time.

The State has already embarked on a very aggressive, forward-thinking energy policy. Not only have we completely revised our own energy strategy as of 1988, but, as a result of the invasion of Kuwait, we realigned our funding and we realigned our strategy so that we are focused clearly on the reduction of our reliance on foreign oil in Pennsylvania. I will say to you very clearly that I think that Pennsylvania has actually done something rather than just talk about our reliance on foreign oil. There are a number of exciting new ventures in Pennsylvania. Let me just tick off a few of them.

For example, we have a very aggressive alternative fuels program under way already. We have invested $1 million in each of the last two years to encourage the conversion of existing petroleum-based burning vehicles to compressed natural gas. We are experimenting with State fleets. We are experimenting with some small business fleets right now. And every indication is that those vehicles run in a cleaner, cheaper, safer manner than petroleum-based vehicles. Our hope in Pennsylvania is to lead by example, to achieve critical mass, and finally get it through to the consuming public that there is an alternative available today. There is a new technology that they can apply, and we in the Energy Office are going to provide every possible assistance to make that happen.

Secondly, we are also funding some interesting research in the use of electricity and hydrogen. This winter it led to a breakthrough in Pennsylvania in hydrogen fuel cell technology, which reduced the cost of hydrogen to approximately a $1.12-per-gallon-of-gasoline equivalent, and the only emission from this car is water vapor. We are hoping that that experimentation can go forward and we can have similar successes in other areas. For example, we demonstrated the world's first electric mini-bus in Allentown, Pennsylvania. It is currently in operation.

We are very much involved in energy efficiency. We have established a multi-million dollar approach to demand-side management measures. We are working with utility companies and with the consumers to impress upon them the need to be as careful about their energy use as they would about their water use or other finite quantities that they have. We are also doing extensive review and inventory of our 10,000 State-owned or operated buildings in Pennsylvania. The combined energy bill for these buildings, by the way, is over $100 million a year. We are inventorying all of them. Twenty-five hundred of them are heated with oil, and our hope is to recommend alternative fuels to the extent possible so that we can reduce our own fuel bill and demonstrate, again by example, that it is possible to do this in the business and the residential sector, as well.

Those are some of the things we are doing. There are many more contained in the written testimony. We are perfectly pleased to provide whatever other information you may require from us in the weeks ahead.

There is one thing that I do want to mention, as well. We have taken the liberty in the Energy Office of working with our own Congressional delegation to provide the Pennsylvania spin, if you will, to suggest the types of things that seem to work in Pennsylvania and to incorporate them into actual Federal legislation that is currently being drafted. We do not presume to have the skill or the breadth of knowledge that this committee would on the subject, but I do hope that our contribution to the National energy strategy debate will be helpful. Many of those provisions are based on some of the best thinking that exists in legislation that is currently in the hopper—Congressman Panetta's bill, for example, contains a number of very exciting and very forward-thinking provisions, and we would borrow heavily from that in our own package of legislation.

The specifics of the "Pennsylvania plan" are contained in the written testimony, and we hope that we can circulate a draft of that legislation via our own Congressional delegation within the next several weeks.

So, without belaboring the issue, we agree strongly in the concept of energy efficiency and conservation, research and development, and a more balanced energy strategy. It would be good for Pennsylvania and it would be good for the country.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Singel follows:]

Statement

of

Mark S. Singel

Lieutenant Governor

Commonwealth of Pennsylvania

before

the

House Committee

on

Science, Space and Technology

Washington, D.C.

February 28, 1991

Introduction

Good morning, I am Mark Singel, the Lieutenant Governor of the Commonwealth of Pennsylvania. I appreciate the invitation to testify at the House Committee on Science, Space and Technology's hearing this morning on the National Energy Strategy. I hope to give you some insight from the states' perspective on national energy planning.

As the Chairman of the Pennsylvania Energy Office for the past four years, I have been involved in the development and initiation of long term energy policies and innovative energy projects which will guide Pennsylvania along the path to a bright and independent energy future. The steps we take today in resolving the issues surrounding our current energy needs and environmental concerns will lead us into the 21st century. Let us hope we all make wise decisions.

The Importance of a National Energy Policy

A viable national energy policy is important to the future well-being of the states and the nation as a whole. It is increasingly clear that our production and use of energy is integrally linked to many of the basic facets of our society -- the environment, the economy, national security, education and the health and welfare of our citizens. The current war in the Middle East has once again driven home the need for far-sighted energy policies that will provide a transition between today's energy economy --

dependent on doubtful foreign sources -- and a new and more efficient economy, reliant on innovative emerging technologies.

The success of this transition will determine the economic future of many states. Jobs, our natural resource base and economic development will all be impacted by the shape of future energy decisions. Some states, like Pennsylvania, need the guidance of a strong energy policy to assist us in developing the interim alternatives to, and alternative uses for, our fossil fuels.

A national energy policy can be an effective tool in reaching other goals as well. It can send a strong message to the marketplace about trends in future energy development and can give a needed boost to innovative and renewable technologies. It can establish an agenda for legislative action that can best be addressed at the federal level like national CAFE standards or federal tax incentives and disincentives for energy use and production. It can provide a mechanism to promote increased technology transfer between and among the states and the regions.

Key to our long-term energy strategy must be the role of energy efficiency. Energy efficiency offers a practical means of achieving many of our energy goals. Increased efficiency will decrease our reliance on imported oil, reduce the environmental impacts of our traditional fuels, enhance the competitiveness of U.S. industries, slow the depletion of our fossil fuels and extend the time we have to make the transition to new and more sustainable energy technologies. Efficiency also enjoys clear and strong public support, but often faces significant market barriers.

The principal goal of a national energy strategy, however, must be to provide secure and affordable long-term energy supplies and services that will ensure the health of our economy and our environment. The basis of a national energy strategy should be a least cost approach to energy decision making -- one which seeks to minimize total societal costs, including environmental and energy security costs, and which treats both supply and demand side resources in an equitable manner. It is imperative that when we price energy today, we include as part of that price, an imputed, realistic cost for externalities such as environmental clean-up and hazardous materials storage. We no longer can push these costs off on future generations.

The President's National Energy Strategy

Having said what a national energy strategy should be, it is now time to come to grips with the National Energy Strategy proposed by President Bush last week. While this National Energy Strategy does embody some of the principles I previously mentioned -- for example, some tax incentives for energy conservation measures -- in general, it shows a blatant disregard on the administration's part for any long-term and meaningful policy concerning this nation's energy production and consumption. It does not lead us forward into a sound, economically viable and energy independent future, but allows us to continue to drift further into the abyss of dependence on foreign oil and its alluring, yet unrealistic, low cost in today's market.

The President's National Energy Strategy virtually ignored energy conservation and efficiency. The National Energy Strategy should have been used to address barriers to both economic energy efficiency and energy production strategies. It should have sent a strong message to the marketplace about trends in future energy development, giving a needed boost to conservation and renewable technologies and it should have provided a mechanism to promote increased technology transfer between and among the states and the regions. The National Energy Strategy should have established an agenda for legislative action that can only be addressed at the federal level. But it did none of those things.

Furthermore, I must reject the views of those who characterize efforts to encourage cost effective conservation and efficiency improvements as unacceptable government interference in the marketplace. It is curious to me that these same people are frequent proponents of government promotion and financial support for traditional energy sources. The National Energy Strategy's reliance on the free market approach for our traditional energy supplies should have been accompanied by a realization that the current prices for these supplies do not reflect fully environmental costs, energy security costs or other external costs. Also many of our traditional fuels and technologies have enjoyed major financial support from the federal government. In Pennsylvania we support research, development and demonstration of a wide range of technologies that will best meet our future energy needs -- coal, natural gas, oil, biomass, solar, wind, geothermal and energy efficiency must be evaluated equally and provided equivalent opportunities to compete in the energy marketplace.

The President's National Energy Strategy should have recognized the fundamental link between energy production/use and the environment, and should have put to rest the outdated view of the mandatory tradeoffs between the environment and the economy. Few ideas are as threatening to our national future as the belief that actions benefiting the environment will necessarily threaten the economy and vice versa. It is increasingly clear that our production and use of energy is inextricably and critically linked to our economy, our environment, our national security and the health and welfare of our citizens. The National Energy Strategy should have provided a vision for the near, medium and long term energy future of the country and should not have been a collection of nearsighted policies solely benefitting traditional energy producers.

Recommendations to Improve the National Energy Strategy

From a state perspective, and based on the work of the National Association of State Energy Officials and the National Governors Association, I believe that the principal goal of a national energy strategy should be to provide secure and affordable long term energy supplies and services that will ensure the health of our economy and our environment. I believe energy efficiency must be primary. I believe a cost/benefit analysis should be applied in which the full long-term cost of each option in taxes, consumer energy bills, environmental impacts, and security risks such as the costs of war or military build-ups short of war, are weighed against the availability or conservation of energy it can be expected to generate.

I also believe it is extremely important that the National Energy Strategy be balanced. I support equivalent tax and other incentives to encourage domestic energy production, renewable energy technologies, and efficiency and conservation investments. I believe these initiatives are essential to providing diverse, affordable and reliable energy supplies for the future.

The President's National Energy Strategy could be improved by a realignment of the Department Of Energy research budget, improved technology transfer programs, greater support for alternative fuels, integrated resource planning and increased CAFE standards. It could also be improved if it would recognize that the recycling of municipal solid waste makes a significant contribution to energy efficiency and is more environmentally benign than the use of that solid waste to produce energy.

There are other options which require more careful consideration and debate. Some of the recommendations involve energy production in environmentally sensitive areas like ANWR and the OCS. While the President's plan recommends improved licensing for nuclear plants, it does not substantively address the questions of storing nuclear waste.

Also, lacking is a clear understanding of the significant contribution coal -- utilized as a resource to produce electricity, hydrogen and coal bed methane -- has and can continue to make as a clean source of energy. Integrated resource planning should be a central focus of the entire plan.

Also missing from the Strategy appears to be a strong federal role in emergency planning. Since the Strategy does not alleviate either our current or future dependence on foreign oil supplies, the U.S. must be prepared to cope with the impacts of a shortfall of petroleum supplies. The Strategic Petroleum Reserve is a powerful tool which must be filled to a greater volume than currently provided for under the law. Directing the U.S. Department Of Energy to provide more accurate and timely information on supplies, to develop Regional Product Reserves and to create state petroleum set-aside programs would provide the states with tools to be used in the event of an energy emergency.

The State Approach to Energy Policy

Developing effective energy policy is certainly not new to the states. We have been on the front line for a long time, and have most often taken the lead in developing innovative policy and programs to provide affordable energy services to our citizens and industries. States also play an extremely critical role in the delivery of energy services because of our regulatory authority. We implement and enforce both federal and state environmental law; we regulate the electric and natural gas utilities and we oversee the siting of new energy facilities. States are also the primary delivery mechanism for federal energy programs from the Department of Energy.

In Pennsylvania, we have been developing statewide energy policies since 1974, and these policies have laid the groundwork for the state's successful energy programs and projects. Let me give you a few examples.

State Programs

In our 1988 energy policy, we recommended the use of alternative fuels to address the problems of increasing air pollution and increasing oil dependency. We established an Alternative Transportation Fuels program at the Pennsylvania Energy Office and committed a million dollars each year for the demonstration of compressed natural gas (CNG) technologies. The program's short term objectives offered financial assistance to vehicle fleet owners and operators interested in converting their fleets to operate on CNG. The program's long term objectives will demonstrate emerging alternative transportation systems.

This year we are spending another million dollars from our oil overcharge allocation for research, development and demonstration of alternative fuels, and are working with the state departments of Transportation and General Services to convert state vehicles to alternative fuels use.

We are also funding research in the use of electricity and hydrogen, which earlier this winter led to a breakthrough in hydrogen fuel cell technology which reduces the cost of hydrogen to $1.12 per gallon of gasoline equivalent, and the only emission from this car will be water vapor. The world's first hydrogen powered fuel cell electric car will soon be available in Pennsylvania. In addition, we cosponsored, with the state's electric industry, the world's first electric minibus, demonstrated in Allentown, Pennsylvania. We are also funding the design and construction of a four-passsenger electric commuter car that will incorporate both batteries and photovoltaics.

Another of our policy objectives in Pennsylvania has been to promote greater use of energy efficiency by and for our electric consumers. We are supporting these practices, commonly referred to as "demand side management" through a million dollar utility/consumer partnership program. The program will have three components. The first component will offer technical assistance to Pennsylvania electric utilities in the design, regulatory approval, and implementation and evaluation of demand side management programs. The second component will provide matching funds for the installation of demand side management measures, while the third component will provide an educational campaign for electric utility customers.

In another program, we are investing another million dollars to achieve greater energy efficiency in our 10,000 state-owned and operated buildings. (The combined energy bill for these facilities is more than $100 million annually.) The Pennsylvania Energy Office is working with various state agencies to design energy programs that are tailored to each agencies' needs, and we are targeting first the 2,500 state buildings heated with oil.

In Pennsylvania, we've also recognized the important links between education -- particularly math and science -- and our future energy and environmental policies. Last fall, the PEO sponsored a conference for state elementary teachers to design a new science curriculum. The conference was so successful -- and important to our teachers -- that the educators continue to volunteer their time -- on weekends -- to move curriculum development along.

Like Pennsylvania, other states are providing innovative leadership in developing energy policy and programs. The State of New York, through its EASI program (Energy Advisory Service to Industry) has successfully demonstrated the ability to achieve significant cost-effective industrial energy savings at low cost. The program involves having energy engineers conduct technical energy audits, followed by implementation of program measures with zero or low-interest loans.

Utilities in the Northeast, and elsewhere, are actively involved in supporting energy efficiency lighting by providing for installation of compact fluorescent light bulbs. Several New England states, New York, and states in the Northwest are aggressively pursuing demand side management programs. California, Texas, Oklahoma and Colorado have excellent alternative transportation programs. Many states -- like California, Maryland, Oregon and Pennsylvania -- are taking the lead in developing emergency plans to handle energy shortages. The state of Iowa has undertaken an innovative sustainable agriculture program which provides both significant energy and environmental savings.

A National Energy Resources Bill

The principal goal of Pennsylvania's energy policy is to provide a variety of secure and affordable energy services and resources that will ensure the health of our economy and our environment. To support this overall, we have identified eight key objectives:

- To use energy resources prudently and efficiently and to pursue a least cost strategy to reduce the cost of energy services to all Pennsylvanians.
- To make our energy system more reliable and secure by pursuing a diverse, flexible and balanced energy mix.

- **To promote the economic development of Pennsylvania's indigenous energy resources in an environmentally sound manner.**
- **To provide Pennsylvania's low income population with affordable and secure energy services.**
- **To improve the Commonwealth's regulation of energy industries in order to improve service, reduce costs and to balance fairly the needs of both energy users and energy producers.**
- **To provide Pennsylvanians access to the information they need to make sound energy choices.**
- **To plan for future energy needs and opportunities.**
- **To plan for potential energy emergencies.**

These goals and objectives have provided a sound framework for making energy decisions at the state level, and have guided the Pennsylvania Energy Office in implementing many of the innovative and far sighted programs I've mentioned today. Likewise, we believe that these goals and objectives can provide a similar framework for the nation as well. For that reason, I have asked the Pennsylvania Energy Office to work with the members of the Pennsylvania delegation to draft an energy bill that will both incorporate and complement our work in Pennsylvania.

Briefly, the Pennsylvania proposal will:

- **Encourage residential and commercial investments in energy efficiency and renewables.**
- **Direct that the Department of Commerce promulgate national standards for recyclable materials.**
- **Encourage greater use of mass transit.**
- **Increase federal research and technology transfer programs, particularly in the areas of energy efficiency and renewables.**
- **Expand the Strategic Petroleum Reserve and authorize its use to moderate fluctuations in the world oil market.**
- **Direct state public utility commissions to consider new planning and ratemaking procedures to encourage utility energy efficiency and demand side management programs.**
- **Require the manufacture of more fuel efficient automobiles.**
- **Require that federal buildings and agencies be more energy efficient.**
- **Promote the use of clean coal technologies and alternative fueled vehicles**
- **Expedite the siting and construction of natural gas pipelines.**
- **Require increased recycling of newspapers and used motor oil.**
- **Provide funding for low income energy services.**
- **Improve energy education through enhanced science and math programs.**

Conclusion

In conclusion, I'd like to reiterate that the development of an effective, balanced and innovative national energy policy should be a high priority on the national agenda. Our national security, our environment and our economy will all depend upon a comprehensive and focused approach to energy planning. This decade must be a time when we plan and implement new programs that will move us towards a more sustainable society in the next century.

If, however, the federal government, as witnessed by the President's proposed National Energy Strategy, fails to play a major role in these efforts, the states will continue to fill that void and provide the necessary leadership to provide this nation with the necessary vision to lead us to a more sustainable energy future.

I am submitting a full copy of my remarks as part of the record. I want to thank you for this opportunity to testify on behalf of our nation's energy future.

The CHAIRMAN. Thank you very much, Governor Singel. Needless to say, we in the Congress are looking to the States to show some of the leadership which they have assumed to their very great credit in this and other fields, and we hope to be able to benefit from their experience.

Now, we have our distinguished colleague, Mr. Leon Panetta, who is chairman of the Budget Committee and whom we would normally have recognized first, but, according to the biblical injunction, the last shall be first. We will therefore recognize him last. At least two of the previous witnesses have damned your legislation already with faint praise by admitting that it is a good start but it needs a little working over. So you may proceed and tell us how to work it over a little bit.

STATEMENT OF HON. LEON PANETTA, A U.S. REPRESENTATIVE FROM THE STATE OF CALIFORNIA

Mr. PANETTA. Thank you, Mr. Chairman.

Having worked with the budget over a number of years, and having had others work over that, I suspect that the same thing will happen on energy proposals.

First of all, I apologize for being late, but I had a meeting with the majority leader and leadership to discuss the supplemental and budget-related problems, and so I apologize for being late.

I would ask unanimous consent that my statement be made part of the record, and—

The CHAIRMAN. Without objection.

Mr. PANETTA.—allow me to summarize it as best I can.

This committee, under your leadership, Mr. Chairman, has been, I think, in the forefront of trying to advocate that we establish a balanced energy policy for this country, and I look at the membership on both sides that are part of this committee and there is no question in my mind that this committee is trying to look at an approach that really does try to confront the energy situation in this country. So I'm not going to engage in the reason so obviously why we need to do this. I think all of us understand that—particularly the members of this committee. I guess my only hope is that we learn the lessons of the past and don't have to repeat the same mistakes that have taken place over the last few years that have brought us to the same situation that we confronted ten years ago. So I think all of us are basically preaching from the same book with regards to the need to develop an energy policy for this country.

Let me spend a few moments discussing the key elements of the bill that I have submitted, H.R. 560. It is an effort to try to establish a balanced approach. I have taken on some controversial issues. But, on the other hand, I don't think you can develop an energy policy for this country if you are not willing to make tough choices. It is, to that extent, very similar to the budget situation. You cannot confront the deficit unless you are willing to make tough choices. You cannot confront the energy situation in this country unless you are willing to make tough choices. If you try to avoid those choices, you are not going to come up with a good energy plan for the country. It is that simple.

And so what I guess I'm challenging my colleagues in the Congress to do is to make some of the tough choices that will put a strong energy plan in place.

The key elements of it that are part of my bill are as follows:

I think it is important that we try to secure our supplies for the future. One of the ways to do that is with the strategic petroleum reserve. It needs a dramatic increase in terms of its current levels. What we propose in the bill is that we increase the SPRO from its current level of approximately 570 million barrels to 1 billion barrels in 1996, and to an eventual level of 2 billion barrels. It is obviously important that, because of the threats of severe oil disruption that have occurred in the past and that could continue to occur in the future, it is absolutely essential that we have our strategic petroleum reserve built up because it is our strongest line of defense against a potentially crippling disruption in the future.

Secondly, you need to establish a floor price for oil. The world oil market is highly volatile by its very nature, and it is particular unstable and prone to large-scale disruptions because so much of the world's least-expensive oil lies in obviously a politically unstable part of the world. To help stabilize U.S. energy consumption and production, the legislation would enact a floor price for oil of $16 a barrel.

The purpose of the floor price is two-fold. I know it is controversial, but it is important to understand why we ought to seriously consider doing that.

First, it gives consumers the signal to continue to conserve energy. Second, it gives domestic producers the assurance that a future decline in oil prices will not wipe out their investments.

We also need to establish greater cooperation with regards to our western hemisphere. The legislation would help diversify the world's oil supplies through promoting western hemisphere energy cooperation by the U.S. government. It would mandate that the President prepare a report to Congress on this energy cooperation, and that specific options would be presented with regards to countries such as Mexico, Venezuela, and Canada that could lead to higher oil production capability in these countries.

The second part of the bill basically deals with conservation grants and requires greater efficiency with regards to energy and the Federal Government.

Energy conservation grants are promoted here by restoring adequate funding for energy conservation and weatherization grants for low-income homes, schools, and hospitals. Federal emergency management program is also established consisting of loans to be managed by the Department of Energy to promote energy conservation throughout the Federal Government. We in the Federal Government ought to set the example for the country in terms of energy efficiency.

We also need to enhance conservation by utilities. The bill supports and further enacts conservation measures by utilities. It would provide State utilities and would require State utilities to consider enacting energy conservation incentive plans. We have already done this in California. New York I understand is very much on the same track, and the purpose of this is to provide the incentives to the utility companies to develop that kind of energy conservation in their individual States.

We also provide for exempting payments consumers receive from utilities for energy and water conservation measures from taxation so that you would basically provide an incentive for that.

On research and development, which obviously is of particular importance to this committee, I would like to stress the provisions that we provide for in the bill on R&D over the next five fiscal years.

Energy conservation—the bill would increase Federal spending on energy conservation R&D to 400 million by fiscal year 1994—300 million in 1992, 350 million in 1993, and 400 million in 1994.

On solar and renewable energy, we would increase Federal R&D on these programs by an additional 150 million by fiscal year 1994—268 in 1992, 308 in 1993, 348 in 1994, and 388 in 1995.

Enhanced oil recovery—we would also increase Federal R&D funding for enhanced oil recovery by more than 20 million from fiscal year 1994.

On fuel cells we would nearly double the amount of funding for fuel cell research, bringing it to about 76 million by fiscal year 1994.

Obviously, from my perspective these increases reflect what the country's needs are with regards to Federal support for the development of energy technologies. I don't claim to have a magic formula in devising these funding increases for R&D, but it is up to the committee to decide the exact funding levels, but I think that is generally the ball park that we ought to look for if we are serious about trying to promote those alternatives.

Let me suggest that, in summarizing here, that one of my concerns is that in the President's proposal there are obviously a lot of proposals made, but it really falls short from what we need to do, and there is also, in looking at it from a budget perspective, there is a kind of double message that is being sent. Let me give you a few examples of that.

The NES proposal—National energy statement proposal — states that it will expand the strategic petroleum reserve to $1 billion. That's on page 14 of that executive summary. However, the President's budget seeks no new fiscal year 1992 funding for SPRO and proposes to start filling it again in mid-fiscal year 1992 at such a slow rate that it would take about 24 years, to the year 2016, for the reserve to reach about a billion barrels.

Secondly, the NES states that it will continue to provide assistance to States and utilities to improve energy efficiency in residential and commercial buildings. These efforts include the weatherization of homes occupied by low- income households. That's on page 11 of the summary. And yet the President's budget proposes to terminate Federal funding for all State energy conservation grant programs such as low- income weatherization and the State energy planning grants.

In addition, the NES claims to reduce projected oil imports in the year 2010 by 3.4 million barrels in reduced demand for oil. These savings, however, come not from fuel efficiency but from substituting other fuels for oil. Furthermore, 700,000 barrels per day of this savings is attributed to energy R&D expenditures which, by DOE's own staff admission, are not included in the President's budget.

Those are the kind of questionable savings that are of grave concern to me because, at the same time that the proposal offers to move in the right direction, the resources are not there to, in fact, accomplish those goals.

So, in the end, I think that the point is obvious: we can't just rely on oil production to do the job. We've got to develop a balanced approach that not only promotes the production that we are capable of in this country, but promotes conservation as well as alternative fuel development. Unless we provide that kind of balanced approach, I'm afraid we are going to repeat the mistakes of the past again.

So I would just encourage you to please look at this proposal. I think it offers a balanced approach to energy supply. As I said, it doesn't have all of the answers and I'm sure there are controversial elements of it that we all need to debate further, but I wanted to provide the key ingredients to spur this debate along so that we can begin to try to focus on the energy needs of the country.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Panetta follows:]

STATEMENT OF THE HONORABLE LEON E. PANETTA
BEFORE THE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
February 28, 1991

Mr. Chairman, I would like to commend you for calling this set of hearings on the President's proposed national energy strategy (NES) and thank you for the opportunity to appear before you to testify on my own legislation, H.R. 560, the National Energy Policy Act of 1991. I very much appreciate having the opportunity to discuss my legislation in this forum.

I would also like to take a moment to commend this Committee on its long history of strong support for energy research and development. I have often stated that the tragedy of the Persian Gulf conflict is that we repeatedly have failed to learn the lessons of past energy crises and do what we could to reduce our oil vulnerability. I suspect at times, Mr. Chairman, you may have felt like a "lone wolf" out there and I want you to know that I am grateful for all of your work on this issue.

Last week the President released his national energy strategy to what I believe to be a very disappointed American people. The time is ripe for bold leadership from this Administration and this Congress to develop a strong national energy policy that will truly secure our nation's energy future. This is why I find it so troublesome that the President has failed to meet this challenge.

It cannot be denied that the war we find ourselves waging in the Persian Gulf is largely about oil. The President and the country have asked a half million American men and women to potentially make the greatest sacrifice in this war. Yet the President does not want to "burden" Americans with requiring conservation at home. This attitude seems to ignore the fact that we are at war largely because of these issues. Congress and the Administration owe it to the American people to apply the same type of leadership and commitment we have exercised in fighting this war toward fighting for a more secure energy future here at home.

I have heard it argued that even if the United States was not so heavily dependent on Middle East oil we would still be involved in this conflict. That might be true. However, I would point out that if the United States had a strong national energy policy in place, the conflict itself may never have occurred.

First, the incentive and the temptation for Saddam Hussein to invade Kuwait would have been lower if this nation had a responsible energy policy that kept America's energy supply secure and the world oil market more stable. For example, the elimination of Kuwait's oil production would not have meant the difference between low oil prices and high oil prices to Saddam Hussein.

Second, had the U.S. and the world not been so dependent on Middle East oil, Saddam Hussein would not have been able to amass the great wealth he needed to fund his arms build-up.

Third, and perhaps most importantly, had the U.S. been properly equipped to withstand a long term supply disruption of Middle East oil, we would have been able to face this conflict with more options, in a more objective and less hurried fashion.

Of course, rather than dwelling on what "might have been," we should focus our efforts on doing everything we can to avoid this type of conflict in the future. Toward this end, I decided to introduce legislation which, from my perspective, establishes the framework for a strong national energy policy. What I set out to do was develop legislation which took a comprehensive approach to our energy problem and laid out the policies that, when taken together, would serve to secure our energy future. In doing so, I recognize that I have proposed some rather controversial initiatives and taken on some powerful opponents. Nonetheless, it was my hope that this bill would serve to put these policies on the table and initiate discussion in the Congress and the country on these important issues.

H.R. 560 seeks to assure America's energy future over the short and long terms by taking immediate steps to make us significantly less vulnerable to energy supply disruptions, and by investing resources to promote the use of energy conservation and alternative and renewable fuels to curb our dependence on oil over the long term.

Mr. Chairman, I would like to take a moment to briefly describe the major components of H.R. 560:

SECURING AMERICA'S ENERGY FUTURE

Strategic Petroleum Reserve

The bill would seek to protect our economy from the effects of an oil supply disruption by dramatically increasing the Strategic Petroleum Reserve (SPR) from its current level of approximately 570 million barrels to 1 billion barrels in 1996 and to an eventual level of 2 billion barrels. With such a reserve the United States would be more than prepared to ride out a significant oil supply disruption for many months. Given the limited percentage of world oil reserves contained in the U.S., a large Strategic Reserve is perhaps the strongest line of defense against a potentially crippling future oil disruption.

Floor Price for Oil

The world oil market is highly volatile by its very nature. It is particularly unstable and prone to large-scale disruptions because so much of the world's least expensive oil lies in a highly politically unstable part of the world. To help stabilize U.S. energy consumption and production, the legislation would enact a floor price for oil of $16 a barrel.

The purpose of this floor price is two-fold: First, to give consumers the signal to continue conserving energy, and second, to give domestic producers the assurance that a future decline in oil prices will not wipe out their investments. The floor price would be triggered whenever imported oil prices fell below $16 a barrel.

Western Hemisphere Energy Cooperation

The legislation would also help diversify the world's oil supplies through the promotion of Western Hemisphere energy cooperation by the U.S. government. The bill would require the President to prepare a report to Congress on Western Hemisphere energy cooperation. This report would be expected to propose specific options for United States cooperation with countries such as Mexico, Venezuela, and Canada that would lead to higher oil production capability in these countries. The bill would also permit the President to exempt from the floor price tax (if triggered) a base level volume of oil exports from Western Hemisphere countries.

SUPPORT CONSERVATION GRANTS AND REQUIRE EFFICIENCY IN FEDERAL GOVERNMENT

Energy Conservation Grants

The bill would promote energy efficiency by restoring adequate funding for energy conservation and weatherization grants for low-income homes, and schools and hospitals.

Federal Energy Management Program

Furthermore, the legislation would establish an improved Federal Energy Management Program, consisting of loans to be managed by the Department of Energy, to promote energy conservation throughout the Federal government.

PROMOTING ENERGY EFFICIENCY

Enhance Conservation by Utilities

To support and further the enactment of conservation measures by utilities, the bill would require State utilities to consider enacting energy conservation incentive plans -- similar to those enacted recently by the California and New York Public Utility Commissions -- to reduce consumption.

Tax Exclusion for Energy and Water Conservation Rebates

Additionally, the bill would exempt payments consumers receive from utilities for energy and water conservation measures from taxation.

REDUCED CONSUMPTION IN TRANSPORTATION SECTOR

Motor Vehicle Fuel Efficiency

As more than half of the oil consumed by this nation is used in the transportation sector, initiatives to conserve motor fuels must be a cornerstone of our national energy policy. To this end, H.R. 560 would increase the automotive fleet mileage efficiency targets required by the corporate average fuel economy (CAFE) law 20 percent by 1996 and 40 percent by 2001.

Stand-By Gasoline Conservation Tax

In an effort to continue to encourage the conservation of motor fuels, the legislation would also establish a contingency stand-by gasoline tax that would be implemented when crude oil prices drop. The tax will be set at one-half the drop. The tax will only go into effect when there is a drop in oil prices below the real average price of oil at enactment. Thus, the tax will only grow when crude oil prices fall sufficiently and then by no more that one-half of the price decline. This stand-by tax will help maintain a conservation ethic.

PROMOTING ALTERNATIVE SOURCES OF ENERGY

Alternative Fuel Vehicles

As the Committee is well aware, gains in the area of alternative fuel vehicle development have been hampered by problems in transportation infrastructure. To address this problem, the bill would provide funding on a cost-sharing basis to State, local, as well as private entities to invest in alternative fuel vehicles for vehicle fleets and mass transportation. The bill would also require that, at a minimum, 60 percent of all vehicles purchased by the Federal government in the year 2000 be capable of using alternative fuels.

Research and Development

I would like now to focus my attention on the provisions of H.R. 560 that increase Federal support for energy research and development, as I assume these are the provisions which most interest this Committee. Following is a breakdown of the authorized funding increases for research and development over the next 5 fiscal years contained in H.R. 560:

Energy Conservation: The bill will increase Federal spending on energy conservation R&D to $400 million by fiscal year 1994 ($300 million in FY 92, $350 million in FY 93, $400 million in FY 94 and thereafter).

Solar and Renewable Energy: The bill will increase Federal R&D on these programs by an additional $150 million by fiscal year 1994 ($268 million in FY 92, $308 million in FY 93, $348 million in FY 94, $388 million in FY 95, $429 million by FY 96).

Enhanced Oil Recovery: The bill will increase Federal R&D funding for enhanced oil recovery by more than $20 million by fiscal year 1994 ($40 million in FY 92, $41 million in FY 93, $47 million in FY 94, $49 million in FY 95, $51 million in FY 96).

Fuel Cells: The bill will nearly double the amount of funding for fuel cell research, bringing it to $76 million by fiscal year 1994 ($67 million in FY 92, $74 million in FY 93, $76 million in FY 94, $79 million in FY 95, $82 million in FY 96).

From my perspective these increases reflect what the country's needs are with regard to Federal support for the development of energy technologies. I do not claim to have crafted a magic formula in devising these funding increases for energy research and development. It is up to this Committee to decide what the exact funding increases for the particular programs will be and I look forward to working with you on the specifics.

By contrast to the balanced approach taken by H.R. 560, the President's national energy strategy relies almost solely on increased oil production to secure our energy future. Lacking any serious effort to help us become significantly more efficient, the NES appears to fall far short from what we must do.

Of further concern to me is the realization that many of the energy "savings" forecasted in the President's national energy strategy seem to be dependent on funding increases that appear not to be reflected in the President's own budget request. For instance, the NES states that it will "expand the Strategic Petroleum Reserve to 1 billion barrels" (page 14 of NES Executive Summary). However, the President's budget seeks no new fiscal year 1992 funding for SPR, and proposes to start filling it again (in mid fiscal year 1992) at such a slow rate that it would take 24 years, to the year 2016, for the Reserve to reach 1 billion barrels.

The NES also states that it will "continue to provide assistance to States and utilities...to improve energy efficiency in residential and commercial buildings. These efforts include the weatherization of homes occupied by low income households..." (p 11 NES Executive Summary). Yet the President's budget proposes to terminate Federal funding for all State energy conservation grant programs such as low income weatherization and the State energy planning grants.

As I am sure you know, Mr. Chairman, the NES claims to reduce projected oil imports in the year 2010 by 3.4 million barrels a day in reduced demand for oil. These savings, however, come not from fuel efficiency but from substituting other fuels for oil. Furthermore, 700,000 barrels per day of this savings is attributed to energy R&D expenditures which, by DOE staff's admission, are not included in the President's budget. A further 700,000 barrels of oil per day in energy savings are attributed to the Clean Air Act, a policy which Congress has already enacted. From the supply side, the NES claims to create an additional 3.2 million barrels of oil per day in additional supplies brought forth by additional investments in enhanced oil recovery R&D which also appears not to be in the President's budget request.

These questionable energy savings are of grave concern to me and I would encourage the Committee to investigate this matter further during its deliberations of the NES.

Mr. Chairman, in summing up my remarks I would like to emphasize to the Committee the dangers of the NES's unbalanced "drain America first" policies. The reality is that the accelerated development of oil resources for the purpose of reducing oil imports by the United States in the near term, will only serve to exacerbate our dependence on oil imports in the future.

Just relying on more oil production will not do the job. To assure this nation's energy security, we must conserve energy, we must expand the Strategic Petroleum Reserve, and we must guarantee a stable market for our domestic energy consumers and producers. The NES does not meet these requirements, H.R. 560 does.

The President was challenged with leading this nation into a new decade of energy security. Where the President has failed, Congress must take the lead by acting swiftly to enact legislation that will help develop a secure and more positive energy future. It will take all of the Committees in this body, and the Administration, working together to achieve this goal.

Mr. Chairman, and members of the Committee, I thank you again for the opportunity to testify before you today on this matter which is so critical to the well-being of this nation and look forward to continuing our work together on this issue.

The CHAIRMAN. Thank you very much, Mr. Panetta. We welcome your remaining here as long as you can to respond to any questions, but if you have other commitments we would understand.

I would like to point out to Mr. Ritter that we have a distinguished public official from Pennsylvania here, and in the absence of any Member of the Pennsylvania delegation he had to praise those outstanding members instead of the reverse occurring and your praising him.

[Laughter.]

The CHAIRMAN. Would you like to remedy that defect now?

Mr. RITTER. Mr. Chairman, you have virtually taken my breath away here. I would like to welcome my friend, Lieutenant Governor Mark Singel. I think he has had success at being responsible for the governor's energy program. I, in due course, will have a few comments on his energy program and what he has stated about the President's efforts, but I think at this point we should limit my remarks to praise.

[Laughter.]

Mr. RITTER. Welcome to the committee, Mark. It is a pleasure to have you here.

The CHAIRMAN. I didn't say you had to agree with him, Mr. Ritter.

While we are making introductions, there is a distinguished California scientist here who is a dear friend of mine that I would like to introduce, Doctor Ben Chen. Would you stand up, Ben? Doctor Chen is chairman of the Physics Department at University of California at Riverside, and he tells me that a lot of his money comes from the Department of Energy, so he has an interest in these things.

Now, I would like to, in accordance with the statement I made earlier about being criticized for being reticent, take five minutes for a couple of questions myself first, and then we'll proceed in due order.

First of all, Mr. Panetta, your bill will be favorably received in this committee because it does provide additional authorization for the research function.

Let me ask you if you would consider favorably in the Budget Committee a recommendation from this committee that you provide at least in the budget a portion of the funds that your bill would require for the additional R&D in renewables and conservation and other matters of that sort.

Mr. PANETTA. Mr. Chairman, obviously I wouldn't want to be in a position of promoting something that I don't protect then in the budget resolution. I have to face the same issue on nutrition funding. Obviously, it is a matter for the full committee to debate, but one of the things we have already begun to look at, at least in staff discussions, is the effort to try to advance an energy initiative within the context of the budget resolution, and the centerpiece for that energy initiative would be restoring the kind of funds we talked about.

The CHAIRMAN. What an action by this committee in support of that be helpful to you?

Mr. PANETTA. It would be very helpful.

The CHAIRMAN. All right. Thank you.

Mr. Freeman, there has been a dearth of comment this morning from any of the witnesses about the role that advanced nuclear power sources might play, at least in an interim before we get to the full hydrogen economy, or whatever is the fuel of the future. You have had extensive experience with nuclear. Do you see a potential role for an advanced, modular, inherently-safe nuclear power reactor as a bridge to the time when we will not be able to use fossil fuels?

Mr. **Freeman**. Yes, sir, but the worst way in the world to go about it is to start off with streamlining the licensing process. The American people have lost confidence in nuclear power, and I think that it is wrong to suggest that the way to fix it is to deal with the messenger. The regulatory process is the messenger telling the nuclear industry that the public has lost confidence in their past performance. We certainly can have better-designed reactors that are inherently safer. Nothing is inherently safe, but it can be safer, and I think that nuclear power can play a role in America's energy future, but we need to go back to the drawing board and we ought to cut out all of the misleading advertising that suggests that nuclear power can displace imported oil when we don't have any way to get nuclear power in the gas tank, we haven't developed the electric transportation system yet.

We need much less bravado and much less promotion and to do a whole lot more homework. I happen to be one of the few people left that thinks that there is a future for nuclear power, but, frankly, we need to get back and develop those better reactors and come to the American people with a product. We need to do something more about solving the waste problem.

The Department of Energy should be embarrassed to come before this committee asking for anything else until they can do the job that has been assigned to them, and that is to find a sensible solution to the nuclear waste. Let's get our problem solved and then come back to the American people, perhaps ten years from now, with something that is truly better. That's my answer to your question.

The **Chairman**. All right. One further question. The use of nuclear, whether it is present generation or advanced generation power plants, ties in very well with the strategy of electric vehicles or electric transportation in general. In the President's energy strategy, there is some recognition of this as a potential way out in the future. The fact is, General Motors today can produce and has produced very attractive electric vehicles which could be manufactured in large-scale quantities if certain problems were solved. Among those, of course, is the fact that it is probably going to cost more than the regular car.

The strategy calls for providing incentives for the trading in of old, inefficient automobiles for new, efficient automobiles. Is there any reason why that initiative couldn't be expanded to double the incentive or triple the incentive if the old gas-guzzling cars are scrapped and traded in for a brand new, shiny, electric vehicle which is completely non- polluting? Can we create incentives of this sort?

Mr. **Freeman**. Yes, sir. But could I answer that question, because I read the President's energy strategy and I was struck by the brilliance of the initiative and the language to implement it that said that they encourage voluntary efforts at the State and local government. There is not a nickel in the Federal budget they propose to implement that idea, even in its elemental form. I guess what—your idea is perfectly sound, but we have got to put our money where our mouth is on this energy problem.

The CHAIRMAN. Does anybody else wish to comment on that? Any other electric vehicle experts here?

[No response.]

The CHAIRMAN. All right.

Mr. FREEMAN. Mr. Chairman, I want to also say that I drove one of General Electric's electric cars around the block in Sacramento last week. I got it up to 62 miles an hour just driving around the block. The car will work.

[Laughter.]

The CHAIRMAN. That was in a 25-mile-per-hour speed limit zone.

[Laughter.]

Mr. FREEMAN. Yes. I almost got a ticket.

Mrs. LLOYD. I'd like to ask Mr. Freeman if he got a ticket.

The CHAIRMAN. Now, proceeding in the order that I indicated before, Mr. Morrison is the first one on my list on the republican side.

Mr. MORRISON. Thank you, Mr. Chairman.

A question first for Mr. Freeman. You have advocated— and I respect your enthusiasm—that we don't mess around with where we are. We take some gigantic leaps forward, particularly on restricting the use of imported oil. Yet, some of your experience goes back to the fact that the price tag is pretty dramatic. I guess my fundamental question is: how can we compete as a Nation as we increasingly face that world marketplace if, in fact, we run up the price of energy for the sake of achieving the goals that I think we all believe in?

Mr. FREEMAN. Well, in the first place, the price that we pay for the gasoline in my view does not reflect the price to the American people of importing that oil. We just won the war, but we pay a good size price in our military budget, we pay a good size price in the medical bills that we pay for the air pollution for burning all that oil, and I don't think anyone dares add up the real cost of the imported oil.

But the second point is that the long-term solution is lower cost transportation. It is my considered judgment that once the electric cars are mass produced, it is inherently a lower cost form of transportation to the American people than what we have. The electric car has no moving parts. It will be virtually maintenance free. We have off-peak electricity that will power 100,000 cars in Sacramento with our little utilities power system. So if this committee will take a look at life cycle costs to the American people, I think that what I am proposing is greater economy to the American economy and the manufacture of products that will reverse our balance of trade and make this country much stronger economically.

Mr. MORRISON. Could you expand a little bit on this total cost of this imported oil? You have mentioned now some military costs, but are there others that are hidden there that—why can't we make a list of them?

Mr. **Freeman**. Yes, sir. Anyone will have to concede that some part—and it is debatable as to what part—of our military budget is there because of our dependence on Middle Eastern oil.

This is a bipartisan thing. President Carter announced when he was still in office that we would fight to protect the oil lifeline in the Middle East, and that has been a bipartisan position of the United States government for quite a while, but it costs a lot of money to have the military forces that will protect that oil lifeline, and I respectfully suggest that some fair allocation of those costs have to be assigned to the imported oil.

The numbers on the health affects of burning all this gasoline—we're burning 150 gallons of gasoline in this country in the cities and on the highways. Most of our cities are so-called non-attainment areas, which means that the air quality is worse than what EPA says it should be for health reasons, and those things are real costs. Everywhere in Europe and in Japan the price of gasoline is $4 a gallon. We are under pricing the true cost of gasoline.

But put that aside. Even at $1 a gallon I submit that the long-term cost to the American people of an electrified transportation system will be lower than continuing to rely on imported oil, and no one can sit here and say what OPEC is going to do to us once the economies of the world get going again. We have seen the merry-go-round. We have seen the impact on our economy. We have had three recessions now that have been partially induced by oil shock. I don't know what more evidence we need.

Mr. **Morrison**. Just one other question. You mentioned in your support for nuclear power that you didn't want to streamline the regulatory process. Some of us believe pretty strongly as we have, in this rather quiet period now with no orders for new plants, have seen the development of some new technology. Would you object to some plans for those plants being pre-approved by the Nuclear Regulatory Commission?

Mr. **Freeman**. No, sir. My testimony is this, and I might say that there were 14 nuclear reactors under construction when I took over at the Tennessee Valley Authority. I didn't have any problem with the NRC in getting them licensed. I had problems in paying for them.

I happen to believe that there is a future for nuclear power, but I believe that the nuclear power advocates have lost the confidence of the public, and if you lead with licensing reform there is probably nothing inherently wrong in reforming the licensing process somewhat, but that is not the nubbin of the problem. The nubbin of the problem is that we haven't solved the waste problem in a manner that is satisfactory to the American people and we do not have the inherently safer reactors yet to offer to me as a utility executive. So we're kind of leading with our chin is what I'm saying. I say that it is a dumb strategy, even if you are for nuclear power, and that putting the emphasis on licensing reform rather than putting the emphasis on solving the very real problems that everybody in this country knows exist is just not in the interest of advancing nuclear power.

Mr. **Morrison**. Probably our committee chairman now, Mrs. Lloyd, will join me in saying that this committee is proud of the investment we have made through the years. We think we will have for you, as a utility executive, the sort of advanced technology that can give not only you but the American public confidence, so we want to work with you to make sure we do it right.

Just one last comment, Madam Chairman, to our good friend Leon Panetta. Many elements of H.R. 560, Leon, really do, I think, play into some of the areas of priority for this committee, so we thank you for your leadership. We are going to look at it very, very carefully to use in modifying the President's National energy strategy.

Mr. PANETTA. That was really why I suggested those various elements. I didn't mention on the gas issue— obviously, one of the issues I have also provided for here is a stand-by gasoline tax. I really do feel that the budget summit—one of our failures in the budget summit—and there were a lot of good things that came out in terms of trying to deal with and confront the deficit, but we really didn't talk sufficiently about the energy side of the agenda as part of it. We were seriously discussing doing more on the energy side and it kind of fell to the side. We did do something. But I really do think, as Mr. Freeman has said, that this is an area that we really have got to confront in this country and we keep running away from it.

The Japanese, for example, just in paying their share of the Persian Gulf War—and we hope they do, by the way. It still has to go through their diet—but the Japanese are talking about a $3 to $4 increase per barrel just to help fund their $9 billion in their pledge on the Persian Gulf. Germany just announced about a $0.67 cent increase in their gas in order to help pay for the Persian Gulf, as well.

I just think we need to understand that one way or the other we are going to pay for it, and if we could stabilize that in a way in which every consumer understands that there is a price to be paid here—and I'm not saying it ought to be something that becomes—that undermines our economy. I think that is a legitimate concern that we have to be careful of. But to have some kind of stand-by gasoline tax so that in this period, as the price comes down, we keep the pressure on and don't get the American people to suddenly get hooked on cheap gas again. I think that's very important for the future.

Mr. MORRISON. Thank you.

Thank you, Madam Chairman.

Mrs. LLOYD [ASSUMING CHAIR]. Thank you very much, Mr. Morrison.

I might add that Mr. Morrison is certainly a very able and a key player in the technologies that we are developing and I enjoy working with him.

Mr. Swett?

Mr. SWETT. Thank you, Madam Chairman. It is a pleasure to be able to attend these hearings. Typically what goes on is you establish your credentials with the committee, and you have done that—a very admirable job. I'd like to take just a few seconds to give you a little background of mine to hopefully make that connection between myself and yourselves. I'll start with the Honorable Mark Singel from Pennsylvania. I was born in Pennsylvania, so I have a connection from Bryn Mawr. I thought I would just throw that in since we were talking so much about the connections with your fine State.

Mr. Nitze, I appreciated the comments that you made about the major areas that need to be focused on in terms of conservation and handling of the energy policy. I would like to add in the discussion today that I believe that there are two other areas besides transportation industry, buildings, and education, and I would suggest that one look at infrastructure, and that's something that I am sure that Mr. Freeman is also very much aware of in how much of our energy is lost in transmission losses from the power source to the user.

Secondly, I think, which I would like to address also with my good colleague, Mr. Panetta, the need to look at this on a regional basis, because as we go into the energy discussions in the weeks ahead we are going to understand— or at least find out and come to understand—that many different parts of this country, unlike Japan and Germany, who have a uniform fuel impact across the country, we have, in our country, hot and cold regions that greatly vary the impact of these types of fees that you are talking about, also looking at the rural and urban mix. That is also going to have an impact on how different parts of the country are affected.

Why do I get into all of these things? Well, my background is as an energy developer. I have had the opportunity of working with SMUT on compressed air energy storage facilities, which is a technology that, other than utilizing electric vehicles to bring up the use of off-peak power, this is a storage idea that helps us to levelize our loads. And I have also been very involved in cogeneration and alternative fuel development for industry.

Two examples: I have had the opportunity of meeting with Northern Textile Industries, and at that meeting was able to identify nearly half the crowd whom I had, as a private developer, worked in their facilities trying to help them to maximize their efficient use of their energy supply.

Lastly, my background as an architect has given me a great opportunity to understand the ability to pay back on maximizing efficiency in buildings. On a six-month basis the payback is real. I think that there is certainly a need to look at not just R&D in that area of conservation and maximization of efficiency, but I think we have a real payback that ought to be shown in the budget, and I think that certainly justifies expenditures in those areas and we ought to get into that in an immediate basis.

With all of this in mind, I am interested just in some clarification from Mr. Panetta. If you would talk to me a little bit about how you see the impact of a base price for oil, how that might impact different regions of the country— in particular the northeast, which is the heaviest energy user in the country and probably would be the most detrimentally hit by that—I would appreciate your comments to that regard.

Mr. **Panetta**. Well, I guess there are obviously regional impacts, and that has been an inhibiting factor in trying to develop an approach with regards to conservation and doing it on an equitable basis.

I think the reality is that, considering where the price of oil has bounced all over the place—I guess it has gone up as high as $44 or

$45 barrel and down as low as below $10 — that putting a $16 floor price on it is an area where I don't think it would have significant adverse impacts in terms of the different regions. That's about what we would anticipate, and that is, frankly, on the low side. I would think that the price of oil is probably going to range somewhere above that, but it depends. It depends on what happens in the Middle East.

But the problem you have is to try to develop a balance where we don't create the incentive to become overly dependent on cheap, Middle Eastern oil. If we have a production capacity in this country, then we ought to recognize it, we ought to try to provide some support for that production capacity. I have not been one that advocates that we ought to drill for oil every place, including the coast of California. But, on the other hand, I also recognize that we have a domestic industry and that we ought to try to support it so that we don't make ourselves vulnerable by going back up to 50 percent dependency on Middle Eastern oil. The only way you can do that is by improving the production here as well as improving the conservation.

Mr. SWETT. Is there an opportunity to accentuate regional characteristics in legislation that would allow certain elements of the energy mix to take precedence?

Mr. PANETTA. Well, there are ways to approach it. It depends on how you balance essentially gas tax versus the tax on oil—imported oil. That was one of the ways last year I think that the Congress was playing with trying to balance these regional concerns. So there are ways to try to approach it, to try to minimize these regional differences. But I think the bottom line is this—and it is something I think you have to carry back to your constituents and I have to carry back to my constituents—there is no free lunch, and the time for cheap oil is over as far as I can see. I mean, I think to try to promise people that somehow we are going to go back to cheap oil is the wrong message to send. There is going to have to be some sacrifice.

Mr. SWETT. I appreciate your remarks.

I appreciate the time that you have allowed me, Madam Chairman, and I'll just close by saying that I find that your legislation is most fitting for the future of this country and would encourage a greater emphasis on conservation and efficient use of fuels because I think that that, in the long run, is going to help industry and automobile users to absorb that increased cost in the oil prices. Thank you very much.

Mrs. LLOYD. Thank you, Mr. Swett.

One of the real joys this year is to welcome back a former Member, Ray Thornton. It is sort of deja vu a little bit because he was here in the 1970s when we worked—the Carter Administration tried to formulate a National energy policy and, of course, it fell by the wayside. And lo and behold Ray Thornton is back just when we need him.

Mr. THORNTON. Deja vu all over again, to quote Yogi Berra.

Mrs. LLOYD. Mr. Thornton?

Mr. THORNTON. Thank you, Madam Chairperson and dear friend. It is so good to have the opportunity of seeing another great friend who worked in the development of energy conservation and a strong energy program in the late 1970s and to commend you for this fine approach to the energy problem.

It is certainly true that we should not have to learn the sad lessons of experience more than once, and yet we are now faced with relearning what we did after 1973.

I think it is also true that history teaches us how to recognize opportunities when they exist. At the end of World War II Winston Churchhill said that "This is not the end, it is not the beginning of the end, but it is the end of the beginning." In so saying, America and Britain and the rest of the world set out to rebuild Western Europe and Asia with the marvelous program of marshall plan, recognizing that our interest lay in making sure that they became strong, and we succeeded very well. They became very strong.

And last year the cold war ended, and it is time, I think, now for a new beginning for America. The opportunity of this decade to set the course for America into the next century is unparalleled in history, and I think that the kind of vision that you are bringing to energy is a part of what needs to be done throughout the Congress. I do not see this vision being expressed broadly in government today, and I have been saying for some months now that it is time for us to develop a marshall plan for America—not the marshall plan, but a well-though-out set of strategies to recognize that today our military strength can be accomplished by fast- moving, high-technology, mobile, and cheaper investment in military; that there will be more than a peace dividend; that we have a real opportunity to walk away from the huge standing armies which have been in place over the last 40 years; that as we do this we should be able to address real issues of National security such as energy independence, such as moving our science from the laboratory into high-productivity and competitiveness so that we may address the problems that we have failed to address in this country during the past ten years of human values, human health.

I outlined that in part because I know you are also chairman of the Budget Committee and I hope that, as we move forward through this session, that we may have opportunities to work together to see if we can't develop some comprehensive strategies.

But, getting back to this, this is a splendid piece of legislation. I am a little bit troubled at the $16 per barrel price of oil because it seems to me to be a bit low. I think that the prices over the past several years have indicated that higher prices have not been destructive to our economy and, indeed, that higher prices may be needed in order to encourage alternative fuels, in order to encourage energy conservation, and I would like to have your comments as to whether you have selected that price on the basis that, in your view, it will act as a floor to encourage the conservation, or if maybe a higher price would be needed.

Mr. **Panetta**. Basically, Ray—let me say when I first came to the Congress we were seatmates on the Agriculture Committee and enjoyed learning from him and continue to learn from him on coming back to the Congress.

You have made the point on the floor price. To be frank, what I was trying to do was to set the precedent, and if you are going to set the precedent you can't start out too high.

Mr. **Thornton**. Okay.

Mr. **Panetta**. So my view is that, if we could at least set the precedent for establishing a floor, it may be something that we'll want to continue to look at in the future, but it is going to be tough enough to set the precedent and that's why I put it at that level.

Mr. **Thornton**. Do you think, as I do, that having a program such as this is absolutely essential if we do intend to set new strategies for moving America strongly forward into the next century?

Mr. **Panetta**. We have the experience of the last ten years, in which what happened was as soon as OPEC decided to sell us cheap oil we immediately grabbed at it. And what you started seeing in this country was the capping of wells, diminishment of production occurring, and we just became that much more dependent on Middle Eastern oil.

If you are going to break away from that, if you are going to stop that trend—that's one of those mistakes we made those last ten years. If you are going to break that trend, you've got to create an incentive for continued production in this country. Otherwise we'll fall back into that trap. It is to the benefit of the OPEC countries to get us trapped again. That's the danger. The war is over now. We are going to have increased production. The likelihood is to promote that production they are going to have cheap prices on that oil, the tendency will be to buy it again. We've got to put some brakes on that, and this is one of those.

Mr. **Thornton**. I agree completely, and I would like to ask Jack Gibbons, with whom I've had the pleasure of a lot of interaction over the years, if your ideas of economic health, environmental quality, and National security—I've run out of time. Could he respond to the question about whether, in your view, National security does, indeed, include more than mere military strength?

Mr. **Gibbons**. Mr. Thornton, I believe it does. I think the Nation understands that we are moving from an era of a cold war, the forces of light and the forces of darkness, into a much more complicated world, and our whole sense of National security is broadening now in a very important way. And so, too, in reflection of your comment, is a sense of Nation that we do have certain things of National purpose before us, and if we put our shoulders collectively to that wheel we have enormous opportunity ahead as we commit our National resources, which include not only our energy resources but our human ingenuity, to achieve these long-term goals.

Mr. **Thornton**. Thank you.

Thank you, Madam Chairman.

Mrs. **Lloyd**. Thank you very much.

Mr. Gilchrest?

Mr. **Gilchrest**. Thank you, Madam Chairman.

I have a few questions I'm just going to fire through so I can go to something else.

I do appreciate this learning experience, this debate back and forth, that will have a direct impact on our grandchildren, and when our grandchildren are sitting in this room they will either appreciate what we have done or be discouraged at our ineptitude, so I hope they will appreciate what we have done.

Doctor Gibbons, could you just give me some idea of the percentage of power that is likely to come from solar energy if we pursue it vigorously in this country?

Mr. Gibbons. I think the first thing one has to understand about power from renewable resources is that the price of that which was once, even 15 years ago, totally out of reach, is now within striking distance, despite the fact that we have spent relatively only a small amount of money in pushing this resource forward.

I think if one takes the proper time perspective of a decade or two decades, then one can find a very appreciable inroad being made by tapping renewable sources of energy. The biggest mistake would be to try to commercialize it too fast and therefore make some economic mistakes. But it seems to me we have the basis now for setting some very sensible goals that reach out five, ten, fifteen years into the future, and then set our coarse on those goals and not be confused by near-term swings of price of oil and other things. We have to stay the course on these. If we do, we will find the production from those sources very appreciable, and they are illustrated on my chart on your left.

Mr. Gilchrest. Doctor Gibbons, what real role can ethanol or natural gas play in reducing our dependence on oil?

Mr. Gibbons. I think ethanol, as derived from natural gas or other sources, can be a very important transitional fuel as one moves beyond carbon-based energy sources into a non-fossil-based system. So I would see ethanol as one of those intermediary forms of energy derived from natural gas or other sources—for instance, biomass—that enables you to move from where we are now to where we would like to be. I think, as David Freeman has pointed out, in the very longer, much longer term, we probably want to think about things that move on beyond perhaps alcohols to such things as hydrogen or, directly, electricity.

Mr. Gilchrest. Doctor Freeman, how about fusion? What role—what potential commercial role can fusion play in our energy dependence?

Mr. Freeman. Fusion power?

Mr. Gilchrest. Know that's what we're looking 40 years—

Mr. Freeman. I'm unfortunately only too familiar. We have been working on fusion research at least since 1948 when my next-door neighbor in Knoxville was going to Oak Ridge on project Sherwood. The research has continued for a long, long time. I would continue the research, but as an electric utility executive I wouldn't count on fusion power keeping the lights on in anyone's lifetime in this room. It is the toughest scientific feat that we have ever attempted, to duplicate the heat of the sun on earth and then make it into something commercial. I think it is the jackpot that has to continue to be researched, but after all those years and not achieving scientific breakthrough I'm fairly sober. With all due respect to my good friend, Doctor Gibbons, the high-energy physicists are pretty good lobbyists, and they have a breakthrough at Princeton just about every budget season when I was in the Federal government.

[Laughter.]

Mr. Gilchrest. Super-conductivity? Is that in the same range?

Mr. Freeman. No, sir. I think that super-conductivity is something that could have a tremendously important impact looking to the future in the sense that we could move electricity long distances without losses.

The shape of our energy future 30 or 40 years from now is what this committee decides it wants it to be. I do not think that we are inhibited by scientific options. We are inhibited by the failure to chart a long-term strategy and stick with it. Our R&D efforts have been like moving a football down the field, getting near the goal line, and punting. We just need to eliminate the stop and start approach and recognize that there are scientific and technical solutions that can get us into a clean energy era where we will have a trillion dollar market throughout the world of things to sell. As Mr. Thornton said, let's just have a marshall plan for the United States to develop those technologies, fund the equivalent to the technologies we developed to win this war in 100 days.

Mr. **Gilchrest**. Thank you, gentlemen. Thank you, Madam Chairman.

Mrs. **Lloyd**. Mr. Panetta?

Mr. **Panetta**. Madam Chairman, I have to apologize to the committee, but I am already late for a meeting. I would like to submit also for the record a summary of the legislation.

Mrs. **Lloyd**. Without objection.

I personally want to thank you for being here and your contribution. As you certainly know, this committee is committed to many of the programs that your bill certainly encourages, so we not only look forward to working with you, we're counting on you. Thank you.

Mr. **Panetta**. Thank you very much.

Mrs. **Lloyd**. Mr. Bruce?

Mr. **Bruce**. I had great questions for Mr. Panetta, but we'll let him leave anyway.

I'm just curious, Mr. Gibbons. Have you taken a look at Mr. Panetta's proposal not in the sense of his specific proposal but a floor price on oil and what that would do to energy conservation in this country?

Mr. **Gibbons**. We have not studied directly the question of floor price except to the extent that, as one can assure the investor about some reasonable future path for the price of energy, that investor has a much better basis for making his investment decisions. If there overhangs the future a chance that oil price might drop, let's say to $12 a barrel, then people will be much less inclined to make the investments in energy efficiency or other forms of energy to compete with that.

Mr. **Bruce**. Well, I'm from the sixth-largest oil- producing State in the United States. "Oil Daily" this week ran a story in which, as the peace started to break out, said that oil prices could go below $12 and even as low as $6 a barrel. I can tell you that no one in my district is excited about $6-a-barrel oil when the lifting cost in the State of Illinois is at $16.50 just—that's a break-even point for us.

What do you—have you taken a look at what the impact would be on our competitive status with other countries around the world if we went to a $16-a-barrel for oil?

Mr. **Gibbons**. Well, in the short term, since have tended to be attracted to lower prices of oil, there might be a short-term positive spur to our economy because we would live off that vicarious moment. However, in the long term—and in energy you always have to think, I believe, in the long term very carefully. In the long term it would continue our road of falling behind our competitors in world markets for a resource and energy-efficient economic system, and it would simply set us up to be whacked over the head even harder the next time things roll around—and they will roll around.

I'm reminded of a Senator that told me once he didn't mind so much that fellow shooting himself in the foot, but when he reloaded and fired again he began to worry.

Mr. **BRUCE**. I notice, Mr. Gibbons, on your estimate of CAFE standards and effect on the oil demand between now and the year 2000, that your estimates and the estimates of the Department of Energy are slightly different. Can you account for the differences?

Mr. **GIBBONS**. I hope we'll be able to understand the differences, Mr. Bruce. We feel that what I have called "Disney's law"—you have to be careful—Disney's law says that wishing will make it so.

Mr. **BRUCE**. We live by that rule.

Mr. **GIBBONS**. I'm afraid that in the case of automobile efficiency that wishful thinking might be an easy way to go but it won't get us there, and therefore we are concerned about not only having some assurance that we can get there as a Nation, but some means to back it up. We firmly believe, however, that if regulation—let's say if CAFE occurs and if that regulation gives very contrasting signals to the signal that you get from the price of gasoline, then you are in trouble because you are getting conflicting signals in the marketplace. So we would hope that you would have marketplace signals about the value of this commodity that are in reasonable resonance with the kinds of efficiencies that we are trying to achieve as a Nation.

Mr. **BRUCE**. But where do you guys differ? You do not believe that the auto industries can provide a 40-mile-an- hour [sic] CAFE standard, or that if they provide it the American public would rebel against it and not buy it?

Mr. **GIBBONS**. We are testifying this morning on the Senate side about automobile efficiency, and we believe that one can, in fact, get up into the range of 38 miles per gallon by the year 2000 in a way that is cost effective and does not have economic penalty, but that depends on your assumption about the price of oil in that same time frame and also your assumption about the extent to which the auto industry can invest in the kind of efficiency that is required to make these kinds of automobiles. But we do believe it can happen.

Mr. **BRUCE**. Mr. Freeman, what do you believe needs to be done to restore some kind of confidence of the American public in nuclear energy?

Mr. **FREEMAN**. I think the Federal Government needs to revise its policy with respect to nuclear waste and stop looking for that hole in the ground that they are not going to find to put spent fuel which doesn't need to go in a hole in the ground. The plain truth of the matter is that we have a nuclear waste policy that is designed for breeder reactors and having nuclear waste, and what we have is really spent fuel, which is an interim form that does not need to be put in geologic storage, and yet the public is led to believe that nuclear power waste is not properly disposed of.

In other words, I respectfully suggest that the Congress really needs to fundamentally rethink the issue of nuclear waste. It is not a technical problem so much as it is a political problem. The American people have been led to believe that it is not properly disposed of until we find some deep hole somewhere, yet the spent fuel was never intended to be put in a deep hole. It can be safely stored, as we are in Sacramento, in dry casks right there on the site or away from reactor storage.

So we have got a policy that I regret to say was advocated by the nuclear industry and enacted into law some years ago. It is not being implemented. There is no State that wants it. The Department of Energy has been unable to find a final resting place, and it doesn't need to be hauled across the country and put underground. It needs to be dealt with in a manner that we all know that we can deal with it. But until that problem is resolved, you have people thinking that we shouldn't build any more nuclear power plants because of the waste problem. That's the big problem.

Mr. BRUCE. I just want you to know that the Clinton Nuclear Power Plant is right at the edge of my district, and their big complaint is not nuclear waste storage but the fact that the plant came in ten times over budget. A $460 million plant was built for $4.6 billion. Figures just worked out that way. I don't know whether someone decided let's go ten times—

Mr. FREEMAN. We have had similar experience in the Tennessee Valley and the northwest and throughout the country with the cost overruns, but that's why there is no confidence. But there are better reactors that are being designed, and this committee has had a leadership role. What I'm suggesting is let's get that better product before we start going to the American people with license reform and all those other things because there is no confidence out there now. The better product and some solution to the waste problem that people can understand and it can be implemented are the two ingredients to restore confidence.

Mr. BRUCE. Thank you, Madam Chairman.

Mrs. LLOYD. Thank you very much, Mr. Bruce.

Mr. Boehlert?

Mr. BOEHLERT. Thank you, Madam Chair.

I have to say at the outset that I start with a couple of biases. I am an environmentalist and a conservationist, and therefore, as I look at the Administration's proposed National energy strategy I come up with this phrase: "Never have so many had reason to expect so much from so few and been so disappointed."

Mr. Gibbons, I'd like to ask you specifically, following up on Mr. Bruce and the CAFE standards, as I read the NES, there is no adjustment in the CAFE standards proposed. And as I listen to you, you say we could reasonably expect to get up to 38 miles a gallon by the end of this decade. Why not do it?

Mr. GIBBONS. Do you want me to try to give you the Administration's response to that?

Mr. BOEHLERT. No, no. I want you to speak from the heart.

Mr. GIBBONS. All right, sir. I believe, first of all, that we can do it, and OTA has essentially completed a study of automobile efficiency which we will be getting to the Congress just as quickly as we can within the next roughly month. We are testifying on that matter this morning.

We have a different—apparently a need to really work hard with some folks in the Administration to understand the source of some of their numbers, because we find the effects of, for instance, a CAFE standard by the turn of the century of 38—I think the Administration has looked at 40 miles per gallon. We find the impact to be extraordinarily different from their resulting conclusion about its impact. So I think a very careful analysis of the basis for the claims being made by the Administration for how they will achieve these goals they have set forward is a very important issue. We firmly believe that the goals are achievable. We firmly believe that by providing some kind of National discipline such as a CAFE standard is a way to assure that we can reach those goals. The Administration, as I understand it, feels that somehow that volunteerism will move us along that path, and we are very skeptical about that position.

Mr. BOEHLERT. Couldn't you make a compelling argument? It seems to be—it is twenty seven and a half, which is the current standard, or forty, which is the talked-about proposed new standard. Couldn't you make a compelling argument for somewhere in the middle, split the difference?

Mr. GIBBONS. Well, we tried to make very explicit assumptions about the price of gasoline, the status of technology, and the like, and the cost of or the ability to hold onto the present kinds of features—acceleration, comfort, safety, and the likes—and tried to find what that number implied in terms of what one can do based on holding on to basically the system we have now, and the number we come up with for the turn of the century is not 40 but it is pretty close. It is around 38 miles per gallon.

So it seems to me, at least while one might argue about a mile per gallon here or there, that the principle is there that we can achieve those numbers, but they won't happen automatically.

Mr. BOEHLERT. Well, as Secretary Watkins testified just the other day, his exact words were, "Oil has a stranglehold on the transportation sector of our economy." That's something that has to concern us all and leads me to conclude that we are sort of missing the boat. Let me qualify this by saying I don't come from a major metropolitan area. I represent upstate New York, not the city. But to propose level funding for mass transit for the next five years, for example, in view of this stranglehold that oil has on the transportation sector, to me seems just not wise.

Let me go to a different area.

Secretary Watkins, when he was here, was justifiably proud of the projected impact that the National energy strategy would have on global warming, and that's a subject of great concern because I think it is one of the most serious environmental issues of our time. But I'm wondering if you might be able to suggest—you or any of the other panels— a different mix of energy policies that might have an even more beneficial impact?

Mr. GIBBONS. OTA released three weeks ago a rather detailed study of how one could address as a conservative Nation the issue of carbon dioxide emissions over the next 20 years here, and we found, in a sense, very good news. We found that if you do nothing

CO2 emissions in the U.S. will rise by 2015 to about 50 percent above where they are now; that by taking known technology and applying it, particularly in energy strategies, even assuming that we want to either save money or at least break even, that one can reduce that 50 percent increase down to about a 15 percent increase. Now, that gets you a long way in the right direction, but the question has been: what can we do to reduce emissions by, for instance, about 30 percent? And we found that one could even go that far using known technology, but at a net cost that is quite uncertain—inherently uncertain—because of the trade-off against the future price of oil. But we believe that one has to go—as I said before, the devil lies in the details.

What we'd like to find out is just how solid are the reasons and rationale behind the Administration's plan for this greenhouse gas reduction. Wishing will not make it so, and we have been a little underwhelmed at this point by the hard numbers that seem not to be there behind the Administration's outlook.

Mr. BOEHLERT. Mr. Freeman, do you have a comment?

Mr. FREEMAN. I have just a word there. The most disingenuous statement in the entire National energy strategy was a sentence in there that said that we must meet the carbon problem head on, because they've ducked it completely. The fundamental opportunity is to substitute all the carbon that is used in oil in the transportation sector, or moving, over the next 20 years, to electrify the transportation sector and make the electricity from renewable resources. That will gain you tremendous reductions in the carbon, but there is no program to make that happen. That is the essential missing ingredient, and it is the essential answer to the oil dependency question, as well as this carbon problem. Much of our carbon is in the oil in the transportation sector, and it has got to be displaced with renewable energy, and it can be.

Mr. BOEHLERT. You know, for the R&D budget for fiscal year 1992 there is a two-to-one ratio, twice as much as requested, for fossil fuels and nuclear power over conservation and renewables, and I would suggest it should be just the reverse.

The final question—and I'm going to be very precise on this one—the National energy strategy asserts that any regulations of the energy sector to guarantee a healthy environment must be justified by a very rigorous cost/benefit analysis. One would assume that would also apply to the relaxation of current regulations. Can anyone suggest what kind of cost/benefit analysis would lead to a justification for opening up the Arctic National Wildlife area to oil exploration? How would one assign values to the losses to the ecosystem? That's a toughy.

Mrs. LLOYD. May I ask that the answer be quick because other members have their time and you have exceeded your time.

Mr. GIBBONS. It is an extremely difficult calculation because you are asking to quantify some non-quantifiable numbers. We do believe that such questions need to be asked. I would be happy to try to prepare a response to you for the record.

Mr. BOEHLERT. I would greatly appreciate that, and I'm sure my colleagues would.

[The information to be supplied follows:]

In 1987 OTA looked at the potential for oil production in the ANWR (Oil Production in the Arctic National Wildlife Refuge, OTA-E-394, February 1989). The following except from that report describes the major tradeoffs inherent in decisions to explore for, develop, and produce the potential oil reserves in the ANWR.

BOX 1-C

ISSUES AFFECTING THE ANWR DEVELOPMENT DECISION

1. To what extent would development of ANWR oil resources improve U.S. national security and offer significant economic benefits? Are the likely levels of ANWR oil production, if commercial quantities are found, of real significance to U.S. liquid fuels supply? Are predictions of expected declines in North Slope and U.S. oil production levels correct? Is it likely that world oil markets will be under the tight control of the Middle Eastern OPEC countries at the time when ANWR oil could be flowing into the TAPS pipeline?
2. Are there alternatives to developing ANWR oil that likely would prove more effective at lower cost (including environmental cost)? Could improving the efficiency of the automobile fleet save significantly more oil than ANWR could supply? Would pursuit of alternative liquid fuels such as methanol be preferable to investing in marginal U.S. oil resources? What are the risks of foregoing the development of any one alternative, assuming others are pursued?
3. What might be the benefits of delaying the leasing of ANWR, with or without first determining the extent of its oil resources? Is it likely that an accurate determination of its resources could be made without promising that any commercial quantities of oil would be allowed to be developed immediately after discovery? Are ANWR's potential oil resources worth more to the United States in the ground than they are under timely development?
4. Is the ANWR coastal plain truly a unique and irreplaceable wilderness? To what extent are its wilderness values duplicated elsewhere in Alaska? In other words, is developing the coastal plain truly in the same league as developing the Grand Canyon, Yellowstone, or the other "jewels" in our National Parks and Wilderness systems?
5. Could ANWR oil resources be developed without significant damage to the coastal plain's wildlife and other natural resources?
   - How have Prudhoe Bay and other North Slope development damaged the natural environment? What are the long-term effects of the hundreds of small oil spills that have occurred? What long-term changes to drainage patterns have occurred because of the extensive road network? What solid and liquid waste problems exist, and what has been their effect? Does the growth of the Central Arctic caribou herd reflect its long-term health, or is the appropriate interpretation less optimistic? What have been the effects of increased air emissions on the North Slope?
   - Does current Arctic oilfield technology and practices offer significant environmental improvements over those used earlier on the North Slope? Would problems that existed at the early Prudhoe Bay developments be significantly less of a problem at ANWR because of these changes?
   - What differences exist between ANWR and the North Slope/Prudhoe Bay area, and how will these affect the environmental impacts that might accompany development at ANWR?
6. Could ANWR oil resources be developed without foreclosing the eventual return of the coastal plain to a wilderness state? How likely is it that drilling sites can be rehabilitated, roads dismantled, and other physical effects of development successfully removed? Would development be likely to be temporary, or would the building of the needed infrastructure lead to more permanent development and exploitation of other ANWR resources? Would oil development be followed by natural gas development, extending the time frame of petroleum development well past 20 or 30 years?

Mr. **Freeman**. Let me just give you two sentences. The benefits would be very short-term. The detriments would be very long-term.

Mrs. **Lloyd**. Thank you very much.

Ms. Horn?

Ms. **Horn**. Thank you, Madam Chairman.

I am delighted to have such a wonderful panel that I feel so in sync with. I agree with Mr. Boehlert. I am also an environmentalist and a conservationist. I was a foot soldier in the Carter war. In 1977 I went to Saint Louis County and started a residential energy conservation program and we put all kinds of things together and did some both low-income and just for the regular folks out there. Very, very effective. People loved the program. You all know what happened to the funding in 1981.

I am intrigued with the real cost, because I think if people were paying anything that even reflected it—and, of course, we can't even begin to get to paying for it in terms of our economy and the recession—but, first of all, the dialogue that might give people that information. Secondly, I would have asked Chairman Panetta but he had to leave, if they thought about even a possibility of doing what the Germans and the Japanese are proposing to do. We have to pay for this war. We can't perhaps do something as vague as paying for the oil protection part of the military budget and the health care environmental cost. I know you have all spent a lot of time thinking about that.

In terms of a policy, how can we get the American people to go from the euphoria we are all feeling today to what the Germans and Japanese are doing to their people: "Hey, folks, this has a price tag. Let's pay it." because that I think we all agree is the only way to get away from the oil dependency and the oil-related transportation industry.

Either Mr. Freeman or Mr. Gibbons?

Mr. **Freeman**. If the Congress would put some sort of fee on the gas guzzlers and make that available to electric utilities and give us say $0.02 a kilowatt hour for all the renewable energy we produce, you would see things change in an awful big hurry—change for the better. In other words, about $0.02 a kilowatt hour is the current, roughly speaking, the difference between what renewables might cost and what fossil fuels cost. So that if the Congress were to put a tax on the most wasteful use of energy and have that money available as an incentive to electric utilities and other entrepreneurs to develop renewable energy resources, there would be a dramatic shift over the next five to ten years.

Mr. **Ritter**. If the gentlelady would yield, could the gentleman just describe what renewables he is talking about?

Mr. **Freeman**. Solar power in all of its forms, wind power, hydro power, and we in California consider geothermal as a renewable—although it isn't. It doesn't last more than 25 or 30 years—and, of course, within the notion that solar power can be converted into hydrogen and that form of energy can be transported throughout the United States. So the vision I have and a lot of other people have—and this can't happen immediately, but over a long period of time—is that we can replace the fossil fuel base that we have with a solar-based, and I think there is room for the advanced nuclear reactors. My vision is that we would have an energy economy that would wean itself from oil over the next couple of decades.

Ms. **Horn**. How about some of our States are leading the way. I don't think that's necessarily the way it should be, but they certainly are in a lot of areas. Has either Pennsylvania or California looked at such a tax on the gas guzzlers with that money being rebated back to the utilities?

Mr. **Freeman**. There was legislation for a so-called guzzler/sipper tax in the California Legislature last year that was passed, vetoed by the governor, that probably is going to go through this year, so those ideas are being advanced in the California Legislature.

Mr. **Singel**. We have not yet proposed a gasoline tax, and it is not likely in the case of the Administration that we will. It has more to do with the economic impact than the energy consequences.

Ms. **Horn**. Again, the States are leading the way in many areas and we may have to do it that way.

Thank you, gentlemen. I appreciate your time.

Mrs. **Lloyd**. Thank you very much, Ms. Horn. We certainly welcome you as a new member.

Mr. Walker?

Mr. **Walker**. Thank you, Madam Chairman.

I first of all want to welcome our lieutenant governor to the committee today and to say that we appreciate him taking time to come and testify before us. I am somewhat disappointed at his response to the National energy strategy. I think there is a good deal more to the National energy strategy than has been allowed by he or some of the other members on the panel here this morning, and I will get to some questions in a moment. But I do want to welcome you and appreciate your coming and being a part of our deliberations here because obviously this committee is going to play a key role in the strategy.

I would say to you directly, having just glanced at your testimony here for a second, that one of the things that you need to focus on is: if the President's plan on conservation is the wrong plan and doesn't do enough, then you have better also be blasting what this committee and what this Congress has done in the last few years, because actually the President's plan is 24 percent above what this committee authorized for this year in those areas. So it is not just a problem that has been created by the Administration. In fact, the Administration goes well beyond anything Congress has been willing to do up until that point, and I'm somewhat disappointed not to hear you saying that. I mean, the President has gone the route of coming up with a National energy strategy—I'm not just criticizing you, I'm talking about the panel here. The President has an at least put a strategy on the board. What we have done in Congress in the recent past has been negligible to nothing. Some of the criticism rests here, as well.

Can I go on with my questions now, or are there other people ahead of me?

Mrs. **Lloyd**. It is your turn.

Mr. **Walker**. Thank you very much.

Mr. Gibbons, you were talking a few minutes ago about the CAFE standards and, if I understood you correctly, you were all for increasing CAFE as a way of mandating the government or mandating a fuel economy standard. Has OTA taken a look at the impact of what the policy has done thus far on the economy?

Mr. GIBBONS. OTA doesn't say that we should have CAFE. What we have tried to point out is the effects of CAFE and also its technical and economic feasibility given assumptions about energy price. As I mentioned earlier—I'm not sure you were in the room, Mr. Walker—we are testifying on that manner on the Senate side today and will be happy to get that information to you right away.

Mr. WALKER. Well, the one thing I have seen, though, that—or failed to see in some of the analysis that has been done—is that CAFE, if it is a success story, as some people bill it, it has been a success story at the expense of the American automobile industry. There has been, by percentage, a 59 percent increase in imported cars as a result of CAFE. We have lost 150,000 American jobs as a result of CAFE. There has been a loss of ten manufacturing facilities in this country, while eight foreign manufacturers have built facilities in this country as a result of CAFE. And my guess is that, if you want to extend it and do another increase in CAFE, that more and more of our production will move offshore, or that done on-shore will be done with Japanese investment money. Now, I'm not so certain that that's a major success story that we ought to be touting and suggesting that the future of the country should rest in that kind of a process.

Mr. GIBBONS. Mr. Walker, I would be hesitant to attribute all of those resultants to the CAFE standards. I don't think, in fact, they were that powerful in what happened. But I also would be dismayed if we were to say American ingenuity and engineering is going to have to lie down in the face of Japanese ingenuity and engineering.

Mr. WALKER. No. It is not a case of American ingenuity lying down, it is the fact that the production plants that we have are capable of building the kinds of cars that Americans have indicated their willingness to buy, and once you moved the CAFE standards the fact is that world manufacturing plants are more capable of doing that job than some of ours because they built small cars for the kinds of roads that they had for a variety of reasons.

Now, if you want to talk about ripping down all the American manufacturing plants and rebuilding them, that's fine. I just don't know where the investment dollars are for that.

Mr. GIBBONS. I think that is a very important point, and also a very important reason that we should pace ourselves appropriately in the movement toward more efficient transportation system. If we try to do it too fast, then we are going to have to prematurely scrap a fair amount of our investment. But if we pace that road properly, then the normal investment in plant and equipment could occur us to move in that direction with both a black economic bottom line and an ability to compete in world markets.

Mr. WALKER. I would say to you that 40 miles to the gallon by the year 2000 is not pacing ourselves, and that's what most of the bills around here are suggesting.

I want to go on to something else here, as well.

What is different in any of the proposals that you all put forward here today between what we were doing at the end of the 1970s and what you now propose that we begin doing again in the 1980s [sic]? Is there anybody that is proposing anything in your strategies that is different than what we were doing under the Carter policy?

Mr. FREEMAN. Mr. Walker, I think that it is useful for the record to reflect a few facts to be connected with your comments.

The record is very clear that the Congress of the United States increased the budget for conservation just about every year throughout the 1980s, as well as the budget for renewables, so that when you make a sort of a comment that suggests that the Congress has not been active in trying to keep the essential elements of the energy strategy that I am proposing alive, in contrast to the views of the Reagan/Bush Administration, I think that you are not reflecting the record.

Mr. WALKER. All I said was the Bush energy strategy proposes a 24 percent increase over what Congress was willing to do.

Mr. FREEMAN. Well, I don't know what Congress is willing to do. I'm here testifying trying to seek an answer to that question which we are at the beginning of the issue of what Congress is going to do this year. We are not at the end. But percentages can be very misleading.

The problem that I have with the strategy is that it looks the eye of the storm right in the eye and blinks. It does not deal with the very real problem that we have that we are a Nation, as Admiral Watkins said, where oil has a stranglehold on the transportation sector, and there are very real proposals that the energy strategy turns down.

Mr. WALKER. Well, before you start quoting my colleague too completely you ought to go back and see the context in which Admiral Watkins said that. I'm sorry. I'm over my time here, but I just want to go at this point. You still haven't answered my question. Where is the strategy that you are suggesting different from what Jimmy Carter gave us in the late 1970s that was an unmitigated disaster with people sitting in long gas lines with this committee faced with a solar economy, the solar money we were spending. Do you know what we got out of some of that renewable research we got? We got solar-powered doghouses, solar-powered hot dog cookers, and a number of other unbelievable wastes of money that were mind-boggling for this committee.

Mr. FREEMAN. Mr. Walker, you couldn't be more wrong.

Mr. WALKER. I saw a solar-power doghouse. We brought it in here.

Mr. FREEMAN. Let me just answer your question, if I may, because I think that Jimmy Carter and Gerald Ford and Richard Nixon before him, in a bipartisan way, had this country embark upon the development of a very serious and important and useful energy strategy. Let me just say this, sir.

Mr. WALKER. The 1970s were an energy disaster time.

Mr. FREEMAN. In your opinion they were a disaster, but what—

Mr. WALKER. Yes. That's right.

Mr. FREEMAN. What we developed is a solar and wind industry which is producing tremendous amounts of electricity in California—maybe not in Pennsylvania, but they are producing electricity in California. And we need to get back on the same road of developing those renewables. Your implication that all of the things proposed were wrong is flat out wrong.

Mr. **Walker**. Well, I am a major advocate of using hydrogen as a part of our economy and so on. I think that there are places to do it. All I'm suggesting to you is—

Mr. **Freeman**. Mr. Walker, did it ever—

Mr. **Walker**.—that the strategies that I see here—

Mr. **Freeman**. Did it ever occur to you that the hydrogen has to come from electricity?

Mr. **Walker**. Yes. You know, I do have some understanding of the technologies I'm dealing with here, and—

Mr. **Freeman**. And the electricity sources need to be the renewables so we will have an abundance supply of energy.

Mr. **Walker**. I thank you for helping me understand the technology, but let me remind you also that there are a number of other ways of producing electricity other than renewables that may have some application here, too, nuclear being one of them. So I would simply come back and ask you—you still haven't answered my question. What are you suggesting today that is different from the disastrous Carter policies in the 1970s. I say they are a disaster because the American people believe they are a disaster. Anybody who sat in long gas lines during the 1970s understands that those policies were a disaster. Now, the question becomes: what are you suggesting now that is different than what you probably were suggesting 20 years ago?

Mr. **Freeman**. The policies that we are suggesting are to implement some of the very good ideas that were supported not just by Jimmy Carter but by the Congress and the American people in the 1970s. What happened in the 1980s is that we stopped all those projects. One of them was to take the abundant—

Mr. **Walker**. And we didn't have one gas line.

Mr. **Freeman**. The gas line was a result of a situation in the Middle East where we need to get off.

Mr. **Walker**. It was as a result of government policies that didn't allow the supplies to flow as they should have.

Mr. **Freeman**. What you fail to state is that under the Carter Administration the deregulation of natural gas and oil was where it got started.

Mr. **Walker**. And I happen to agree with that aspect of the policy, but you're talking about aspects of the policy that I would tell you were unmitigated disasters and that the conservation that we got out of those policies was of very little help. I would tell you that when the American people spent thousands of dollars to produce a solar-powered hot dog cooker it was not something which helped us achieve energy independence for the future.

Mr. **Freeman**. Mr. Walker, Admiral Watkins went all over this country and heard the American people, and the message that he heard from the American people is that we want a strong conservation policy. The Congress of the United States in every year throughout the 1980s added to the conservation budget. What we are asking—

Mr. **Walker**. And I'm suggesting to you that Admiral Watkins heard that and put in place in the National energy strategy a strong conservation policy that I think is worth defending, but it simply does not take the totalitarian approach that you mandate everything from the top down. What it suggests is that conservation may be something where, by developing individual policies, that you can encourage conservation from the bottom up.

Mr. FREEMAN. One guy's democracy is another guy's totalitarianism.

Mr. WALKER. Well, but anything that mandates centralized controls from the top down is, in fact, totalitarianism.

Mr. FREEMAN. We're trying to empower the American people by giving them the proper incentives to invest in the lowest-cost source of energy which is conservation.

Mr. WALKER. Thank you. I waiver my time.

Mrs. LLOYD. Mr. Roemer?

Mr. ROEMER. Thank you, Madam Chairperson.

Mr. SINGEL. Excuse me, Madam Chairperson, if I can. I must be off to another meeting. I don't want my absence to be construed as—

Mrs. LLOYD. I certainly want to thank you for being here. I appreciate it.

Mr. SINGEL. Nor do I wish to avoid the opportunity to engage in a bit of debate with my Congressman from Pennsylvania. Let me offer the opportunity perhaps some time in the future to explore energy issues in depth with both Congressman Walker and Congressman Ritter. I'd love to do that.

Mr. RITTER. Madam Chairman, if I could just interject a comment here prior to leaving of the Lieutenant Governor that will just take a minute or so, if that's possible?

Mrs. LLOYD. It is Mr. Roemer's time.

Mr. ROEMER. I yield.

Mr. RITTER. Could you yield to me, Mr. Roemer?

Mr. ROEMER. I do.

Mr. RITTER. Thank you very much. I appreciate that, and I will yield back to you the time that I take.

I was also disappointed, Governor, with your attack on the National energy strategy. I felt it was extremely politicized. And I was really quite disappointed with the plan that you came up with because, as I look at it, in terms of quadrillion BTUs of energy to try to get on the curve as where this country is going or where this country is going even with substantial conservation, I just don't see it happening. You really don't—they are nice things to do. I mean, they'll make everybody feel good. But outside of the co-initiative and maybe some of the deregulation on natural gas, there is nothing in there on oil production, there is nothing in there on nuclear. You trash the President's policy on conservation, and I can tell you in the National energy strategy there is more conservation—

Mrs. LLOYD. Mr. Ritter, if Mr.—

Mr. RITTER. If Mr. Roemer will continue to—

Mrs. LLOYD. Mr. Roemer gets his time in before we have a vote, then I'm going to have to yield to Mr. Roemer.

Mr. ROEMER. Do we have a vote?

Mr. RITTER. We do have a vote, but if I can just finish my sentence, Madam Chairman?

There are—and I would refer you to take a look at the National energy strategy conservation elements that are engaged in the

Watkins plan, and that Watkins plan took two years to develop, you're talking about a plan that you are working on. And yet, in press reports back in my district, you took apart the Watkins plan as if your plan was the next greatest energy salvation for the United States of America, and I think it was rather unfair and rather a cheap shot.

I yield back, Madam Chairman.

Mrs. LLOYD. Mr. Roemer?

Mr. ROEMER. Thank you, Madam Chairperson.

I'd like to thank the panel for their time and testimony today. I apologize for being late. I came from a hearing on the Family Medical Leave Act, which I am very involved in.

I come from a district where we have a plant that is created from new technologies and creating renewable sources in ethanol, and one of the things I would like to ask you is that there is some interesting R&D going on right now in deriving liquid fuels from the biomass. Can you comment on that research? And can you also comment on how that might be used to produce alternative fuel such as ethanol?

Mr. GIBBONS. One big difference between where we are now and where we were in the late 1970s is that research on enzyme technology and other mechanisms for converting lignocellulose—that is, woody fiber—into alcohols has moved along at a remarkable pace. We now have the capability to convert biomass, as you mentioned, to liquid fuels, alcohols, which is the very stuff that runs the Indy 500 now. And I think to sustain Dave Freeman's argument that these advances aren't at a dead end, we should be committing a long- term, sustained effort to push ahead on that frontier because it is so promising, and it is all part of the so-called renewable energy that we load in as so-called alternative energy in our assumptions about where our next liquid fuels are going to be coming from, and it is a very important piece of yellow on that graph on your left.

Mr. ROEMER. Let me ask you all another question, as well, too. One of the problems we face in this country and one of the emphasis that the new chairman wants to put in this committee is in developing these new technologies, whether they be in health care, in recycling, in waste management and reduction, in energy sources. You mentioned, Doctor Gibbons, that we have to look more and more at not making economic mistakes in developing these technologies, yet the Japanese and the Germans seem to be ahead of us in developing some of these technologies. Could you comment specifically on the magnetic levitation train, photovoltaic, and also ceramic gas turbine engines in terms of what progress we are making there and in terms of the competition in the international global environment that we face there, that time line that is important?

Mr. GIBBONS. Let me make a brief and more general response, and I'd be happy to get back to you with details. But, in general, we have a foreshortened future in terms of our research commitments compared to the Japanese in these very areas. The Japanese are moving ahead in high-performance materials such as ceramics and composites. We are very good at the science, but we don't demonstrate the long-term commitment to stay in there with it. And I would suggest that to examine the out-year budgets on the DOE's plan might be one of the best ways to find out how serious the Administration is on committing for the long term here.

Mr. **Roemer**. Could we work together on that, Doctor Gibbons?

Mr. **Gibbons**. We'd be happy to work with you on it, Mr. Roemer.

Mr. **Freeman**. Could I make just this one comment about the one piece under question that I'm familiar with, and that's the photovoltaic cells. It is a matter of sadness to me to have seen the companies that were doing the research in the photovoltaics in this country having been sold to the Germans, the Japanese. This is technology invented in America, and they are developing it. And if we sit around twiddling our thumbs, we'll find the Japanese not only selling cars, but they'll be selling rooftops for our houses with PV cells in them. Here is truly a trillion-dollar market because most of the world doesn't have central station electricity in Asia and Africa, and PVs are it, and yet it has taken the Congress to barely keep that R&D alive through your initiatives and with no help from the Administration for ten years.

Mrs. **Lloyd**. Mr. Roemer, as a new Member I don't want you to miss this vote.

Mr. **Roemer**. Okay. Thank you, everybody. I appreciate it. I look forward to working with you in these areas.

Mrs. **Lloyd**. Can you gentlemen stay on for a little bit longer? I'll be right back.

[Recess.]

Mrs. **Lloyd**. We will resume with Doctor Jack Gibbons. We have been friends a long time. When I came to Congress in 1975 you were one of my constituents with the Oak Ridge National Laboratory, and certainly I have looked to you for advice and leadership, and certainly it is appropriate for you to be here for the hearing.

Mr. Nitze, we appreciate you, as well.

It seems to me as we grapple with energy policy—let me go back to my opening comments. It is also great to see Dave Freeman, who did an outstanding job as director of TVA, and he is also responsible for one of the impressive structures in the skyline of Chattanooga, the TVA Building, that some people sort of pleasantly refer to as a monument to S. David Freeman. We enjoy having it, and we certainly wish you well in your present endeavors.

It seems to me as we look to new technologies to replace oil that there are dimensions that have not been completely reflected on today. We have been hostage to a situation in the Mid East and, as a member of the Armed Services Committee and travelling and looking at what would happen when the big balloon went up ten years ago and I went to countries such as Portugal, and I said, "I can tell you what is going to happen. The countries that have no energy supply will have to come out with their hands up." So very few people recognize the interplay of oil in our defense posture, and this has certainly come to the forefront now.

But we do not have the supply of oil that they have in the Mid East, but I think we do have something more important than this vast supply of oil, and that's the great ingenuity and talent of the American mind and the American will. And it seems to me if we can develop other sources of energy that can replace oil, then we are going to give to those third-world countries and the countries that we are worried about that are inflicting terrorism on our world, that we are going to give them something more stabilizing and more secure than chemical weapons and atomic weapons. We'll give them a source of reliable energy that would be certainly more valuable to them. So, indeed, we have within our grasp the opportunity to develop something more valuable, more beneficial to humankind for decades to come than the present supply of oil, and I think that's the dedication of this committee.

I think it is very important to say at this time that I appreciate—since I don't have a five-minute rule, I'm the only one here now so I can talk—the dedication of Mr. Brown to bring an energy bill, the energy legislation, before the full committee as we open up this new Congress, and we are going to work together and have a good authorization bill out. I'm going to finish my authorization hearings in the month of March so that we will be prepared to go to the floor with a good, solid bill.

As we look at the realities and we work to progressive legislation, though, for the future, David, do you really think that we should abandon all but oil replacement conservation renewable energy programs?

Mr. FREEMAN. No, ma'am. I think my earlier testimony suggested that I do see a role for what my good friend Alvin Weinberg refers to as the second nuclear era. I believe that there should be nuclear technology developed through the leadership of this committee that can be brought to the American people that will reflect the knowledge that we gain so that I see a significant role in the future for nuclear as well as the renewables.

My big problem with the coal resource—and, to a lesser extent, with the natural gas—they are resources that we are going to use for a number of decades and we ought to improve them, but I see them as a bridge because I don't really know how we ultimately accommodate the global warming problem without a new energy order that really phases out the fossil fuels. That doesn't mean that there isn't a role in the program for what I wish we would call cleaner coal because, having bought 25 or 30 million tons of it a year at TVA, it is just hard for me to believe that it ever can be really clean. We tend to overstate our objectives, but we need cleaner coal and the technology to perfect cleaner coal.

As you know, I'm very proud of the fact that when you and I worked together we did develop the fluidized bed at TVA, and TVA was a living laboratory that—

Mrs. LLOYD. And these programs are progressing as a result of what was done in the "Carter era."

Mr. FREEMAN. We got a lot of good things started and, with the help of the Congress, some of them have been finished.

Mrs. LLOYD. I want to ask you: TVA was involved in a coal-to-methanol plant in 1981. What happened to that project?

Mr. FREEMAN. It was killed by the Reagan Administration, despite the fact that it just happened to be located in the district of Chairman Tom Bevill who was the chairman of the Appropriations Subcommittee that handled the money. But there was just such determined opposition to kill every energy project that required any money that the ferocity of the opposition even killed that project, despite the fact that it had the complete backing of the TVA board and of the Congressional committee that was reviewing it. And we had the site and we had the design. We were getting ready to build it. And, if it had been completed, we would know what it would cost to take our abundant coal resource and make the equivalent of gasoline out of it.

I'm not saying that that would necessarily have been the complete answer to everything, but we would have had another major energy alternative, and it is kind of a disappointment to me to see some members of this committee from the coal States who didn't fully appreciate the enormity of the damage that was done to our energy strategy by just killing everything by the Administration who believed that some combination of just buying oil on the world market was going to take care of us. It really hasn't taken care of us very well at all.

Mrs. Lloyd. Well, as you know, I had a renewable and conservation bill that passed in the last Congress, and I think it will probably be brought to light the reason our conservation budget is so low as it is today, as we look back on those numbers, so certainly we are going to get a bill that is a balanced energy bill.

What do you envision as our total energy mix to the year 2000, 2010?

Mr. Freeman. Well, it seems to me that the mix is one - - you know, things change gradually with energy. We started nuclear power basically during World War II, and here we are 40 or 50 years later and the percentage is 15 or 20 percent.

I see the renewables steadily growing, and I see oil shrinking, perhaps coal leveling off and beginning to shrink somewhat, too. There is a major role for natural gas. The exact numbers are not the point. What I think we have to look forward to is getting a long-lasting, domestic, economical energy base, and it strikes me that that is going to be some combination of nuclear and renewables and some fossil fuels, but with the fossil fuels on the decline unless we find out that global warming is not a problem, which I don't think we are going to find out.

Mrs. Lloyd. I think I have some disagreement with you on licensing reform, because when you look at the cost, the stretch-out, the cost of nuclear plants, I don't think we are going to ever get there without some form of licensing reform.

Mr. Freeman. Ms. Lloyd, I don't think our disagreement is so much on the merits of the licensing reforms, but I have had a considerable amount of experience in all parts of the United States with the nuclear issue, and I just believe that if you want to reinstill confidence in the general public with nuclear power you don't lead with the licensing reform and you don't make that the number one feature of advancing nuclear power. If the Administration would come up with a three-point program which says we've got the nuclear waste problem under control, we are going to bring these new reactors to the American public, and, in order to facilitate that, we think that we might streamline the licensing program, that would have had more credibility.

My problem is the attempt to somehow suggest that the major problem with nuclear power is the licensing is just not it.

Mrs. Lloyd. No, I don't—

Mr. Freeman. And, as you know, TVA never had any problems so much with the licensing of the nuclear plants. Our problems were with the cost overruns and keeping our skilled people from leaving us because of other reasons.

Mrs. **Lloyd**. My point is the stretch out of the construction and the cost of money makes nuclear plants in some case completely prohibitive, and my point—and this committee has worked very hard to advance the passively safe reactors, advanced water reactors, as well as liquid metal technology, so we are moving in the direction of better technology. But, at the same time, you aren't going to see utilities make that investment when you have that much stretch out.

Mr. **Freeman**. I think the record should also show, though, that the major reason for the stretch out was the fact that, after Three Mile Island, we all recognized that we needed to go back and rebuild those nuclear plants to incorporate the safety features that we recognize were needed, and that was the major cause of the stretch-our period.

I want the record to show that I am not so much opposed to licensing reform. I think that that obviously could possibly help. The average person, in my opinion, views that as an attempt—and perhaps incorrectly, but they view the licensing reform as an attempt to shortcut the safety concerns. I know that is not the purpose, but there hasn't been sufficient understanding by the public that the waste problem is being handled, if it is being handled, and that the newer reactors are here.

It is kind of a chicken and egg. And I could be wrong, but my sense of regaining public confidence in nuclear, which is lacking today, would be that I'd put the major emphasis on the new technology and reforming the waste—

Mrs. **Lloyd**. That is the thrust of this committee, that it go hand-in-hand with the new technologies that we have developed. I really appreciate what you have contributed to our hearings this morning.

Jack, looking at the energy policy as proposed by the Administration, as I told Admiral Watkins when he was here this week that I thought it was a good beginning point, that I thought there were certainly areas where we could improve on the policy, and in many aspects it sort of reminded me of the diet that I'm always going to go on to lose ten pounds that we sort of put it off until another day because most of the programs would not go in place until we got to the year 2010, and when I talked to the secretary I said, "You know, I really think to make this credible to the American people that we need sort of an energy pie such as we break down our budget and the Federal expenditures, that this technology is going to contribute this much and really show the American people where we intend to go and maybe look at something that we can do in the near term, because any time you have an energy policy that is mainly directed to the year 2010 and the year 2020, then it gets to be hypothetical subjects to the decisions of OMB and you really don't have too much of a policy at that point."

I would like to ask you—the main question I would like to really direct towards you: what technologies can contribute to the marketplace in the near term as well as the long term? I'm looking for the areas where we can make an impact in immediate or near terms for payoffs for our consumers and our taxpayers. What are your ideas in that regard?

Mr. GIBBONS. First of all, there are a lot of technologies that are on the shelf but have not reached the market place for a variety of reasons. Look at the Federal Government's own operations, look at the lights in this room, and we see just enormous opportunities to not only increase the efficiency of use of energy using the new technologies that have emerged, but also do it and save money at the same time.

But in order to do that we have to think about our accounting systems. Industry, that does pretty careful cost accounting as they go along, has enjoyed a steady improvement in energy efficiency throughout this whole turbulent time of the last 15 years because they have watched the bottom line and they have watched the technology and they have made the investments.

It seems to me that a first start might be to say, "Let's start today with the Federal Government's own operations." The 20-year journey has to start with the first day's walking, and it seems to me although we need to set our goals in the multi-decade time frame, that doesn't mean that that's a future activity. It starts today, and I think there are a lot of things we can do with technologies that have been developed over the past ten years that are ready to go to work now.

The second—and that will require market signals, better signals to the consumers about their purchases, straightening out some distortions created by public policies at the Federal and State level.

The second thing we can do is to admit to ourselves that we haven't discovered everything yet. There is a lot of opportunity remaining that will emerge from a sustained support of basic research and development in the area related to energy. And that, again, comes back to the point that the investment today will be paying off in years down the road.

The reason we were able to continue this roll-in of efficiency in the early 1980s as the government abandoned energy was the momentum created in the 1970s that gave those opportunities of chance in the market place. We began to run out of gas a few years ago. If you notice in my slides, our gains in efficiency began to level out a few years ago because we were running out of that earlier momentum that had been created.

So I think we should think about energy in the long term, but that also translates to very specific near-term activities.

Mrs. LLOYD. Have you formed any assessments or audits of our energy programs or directions or goals? Have we prudently invested our R&D dollars on this committee?

Mr. GIBBONS. I have submitted for record a chart labeled Figure 10 which shows in constant dollars how the Department of Energy R&D budget has been allocated over the years, and it gives an interesting display of some things that peaked up during the late 1970s, fell off sharply in the early 1980s, and have been moving slowly since that time. And I think if one looks at that behavior, one recognizes that there may need to be substantial readjustments if we want that partition of resources to reflect the words that are being used in the National energy strategy or in other people's propositions or in, for instance, OTA's three offerings of energy goals. In other words, it seems to me we need to match the relative contribution of these R&D dollars to our goals of where we want to get to in 20 years, and I think when one makes a hard comparison, one finds that there is, indeed, a substantial opportunity to shift some dollars around.

Mrs. LLOYD. We're going to be looking to you to help us with our assessments as we try to look at what each technology can realistically contribute to our energy mix, where we should be spending a little bit more, where perhaps we haven't spent as wisely, but really spell it out to the American people that this technology can do this much and there are times when it isn't wise to spend more than we have done. I think there are indications that there areas in conservation, for instance, that we could have made some stronger investments.

I'm going to go back to my energy and conservation and renewable bill, H.R. 1216, which passed in the last Congress. The chairman asked us to reach an agreement with the minority on the authorized funding level before the full committee marked the bill. As a result of the recommended authorization level, which was reduced, this is where we are with our conservation and renewable budget that has been referred to earlier in the hearings. And we know that we have a lot to do, but this is going to be a very remarkable year, I believe.

Mr. GIBBONS. I might add one point, Madam Chairman, that I think may have been under-represented today. We have focused a lot on energy efficiency because it reflects the American ability to use ingenuity in place of brute force consumption of resources, and it has been an extraordinarily impressive record over the past 15 years. We have changed by fully one third the amount of energy that it takes to produce a unit of GNP.

But, at the same time—and our OTA's proffered goal is to regain and continue that process over perhaps the next couple of decades at about 2 percent per year. At the same time, it seems to me there is relatively less attention to this imperative to move toward the non-fossil energy supply world. That's through renewables or other forms of energy that don't derive from carbon-based fuels.

And I think if one looks at the commitment toward making that move toward the non-fossil world, we are coming up short. So we have to continue to invest in efficiency, but we must remember also that we have to invest in how we make those new kinds of fuels and we should not expect it to come out of the private market place because we have people—major forces, especially in the Middle East where two-thirds of the oil is—that are going to constantly adjust their price to discourage us from developing those fuels so that we will be constantly more dependent on what they want to sell.

I think we would be in terrible shape if we don't understand that those are not market phenomena. They are non- market phenomena, and there is a very rational reason for the American people as a people to make the investments to free us up from that kind of bondage.

Mrs. LLOYD. Thank you.

David?

Mr. **Freeman**. If I could just add this thought, perhaps it would be useful to take a page out of the book of the old Atomic Energy Commission. Back in the 1960s there was a comprehensive 10- or 15-year plan laid out to develop nuclear power to where it became commercial. It was not constrained by this year's budget or OMB's constraints; it was an invitation, I think, from the White House. It was delivered to the Congress.

Perhaps it is time to sit down—for this committee to take that long look and bring industry in. What can we deliver to the American people in ten years if we had the money to do it? And not just government throwing money at it, but in partnership with the industrial forces that would actually do the work?

There is a lot of skepticism about whether renewables will ever be a very large part of our resource base, but I think that skepticism could be eliminated by a specific long- term RD&E program, and I would urge the committee to get out of the shackles of even this year's budget and look at what it would take and then let us ask the question "Can we really afford not to do it?"

Mrs. **Lloyd**. Mr. Nitze, I see you nodding your head. I'd like to have your input at this point.

Mr. **Nitze**. Thank you, Madam Chairman.

I have learned a tremendous amount, and I must say I agree enthusiastically with almost everything that both of the other two witnesses at the table have said.

I'd like to say a few words about the international dimension to aggressively pursuing the development of the technologies we have been discussing.

The United States in a sense is the model for the large, developing countries such as China, India, and Brazil. We share many characteristics with them in terms of our geography, in terms of our diversity. And, frankly, our open system has encouraged them to look to us for education, for training, and for many different ideas. They have tens of thousands of students in our university systems. They have nationals of their countries working in every aspect of American life.

And therefore, if we are interested in seeing these countries move towards a more sustainable energy path, we are the model, we are the example, and we have the international leverage just in terms of human contacts and human participation in what we are doing. They look to us.

The Netherlands, Denmark, even West Germany, are not the kind of models for these countries that we are for a variety of reasons.

I talked to a Brazilian once who said, "You know, Denmark is a wonderful country, but it is like a garden." The United States is a real country in Brazil's mind for a variety of reasons because we share many characteristics with Brazil.

There is a second international multiplier effect. Not only will we get a tremendous copy or repetition effect abroad, but there is a huge opportunity for American exports of goods, products, and technology in these countries. And if we think there is a rebound affect from rebuilding Kuwait— and there will be a substantial one—the rebound affect of us taking this agenda seriously in terms of our ability to sell into the major developing countries is hundreds of billions of dollars. So indirectly we will be enriching the American people and assuring the future of American industry if we take this agenda seriously. It is a huge double or triple win internationally, and I think it is very important for this committee to recognize that.

Mrs. **Lloyd**. Something my Dad taught me a long time ago is that your responsibility is dependent on your opportunity and what you can do with your God-given talents. Certainly we have an opportunity now, and we have the talents to develop new sources of energy, and this sort of equates as our responsibility, so I certainly appreciate your input.

I think this has been a remarkable hearing. If you gentlemen have anything else you'd like to say before we close out? Doctor Gibbons?

Mr. **Gibbons**. Madam Chairman, I can't help but remark that it has been so pleasurable for David Freeman and myself to be with our fellow Tennessean again this morning. It is not a conspiracy; it is a meeting of like minds and good souls. Thank you.

Mrs. **Lloyd**. You certainly know that you have my utmost respect.

I would ask unanimous consent—and I'm sure I have it — that all opening statements will be made a part of the record.

And if there is no further testimony, the—I thank you again. And I'd also like to thank the staff for the excellent job of putting this hearing together.

Our committee stands adjourned.

[Whereupon, at 1:00 p.m., the committee adjourned, to reconvene at the call of the Chair.]

APPENDIX IV

Opening Statements Submitted for the Record

HONORABLE MARILYN LLOYD

OPENING STATEMENT

FEBRUARY 28, 1991

I WOULD LIKE TO TAKE THIS OPPORTUNITY TO THANK CHAIRMAN BROWN FOR BEGINNING THIS CONGRESS WITH THE EXAMINATION OF ENERGY ISSUES AND THE COMMITMENT TO PURSUING AN ENERGY POLICY FOR THIS NATION. IT IS PARTICULARLY ENCOURAGING IN THAT I KNOW THE CHAIRMAN RECOGNIZES THE NEED FOR A LONG-TERM APPROACH TO THIS POLICY — NOT SIMPLY AN EXPEDIENT, QUICK-FIX UNTIL THE NEXT CRISIS.

OUR SUBCOMMITTEE ON ENERGY BEGINS ITS AUTHORIZATION HEARINGS NEXT WEEK AND HAS AN AMBITIOUS SCHEDULE TO CONCLUDE THOSE HEARINGS IN MARCH. SOON THEREAFTER, WE PLAN TO PRESENT THE SCIENCE COMMITTEE WITH A THOUGHTFUL PLAN FOR OUR ENERGY RESEARCH AND DEVELOPMENT PROGRAMS BOTH FOR THE COMING FISCAL YEAR, AND MORE IMPORTANTLY, FOR THE LONG-TERM.

THE ARENA OF ENERGY POLICY IS A VAST ONE. THE ENERGY SUBCOMMITTEE WILL FIRST ATTEMPT TO DEFINE OUR LONG-RANGE GOALS FOR OUR RESEARCH AND DEVELOPMENT EFFORTS AND SET A COURSE FOR OUR FUTURE PATH. THESE ISSUES MUST BE CAREFULLY THOUGHT OUT BECAUSE IT WILL REQUIRE A SINCERE AND DEDICATED COMMITMENT ON THE PART OF CONGRESS TO SEE THESE PROGRAMS THROUGH TO FRUITION OVER THE LONG-TERM. WE CANNOT CHANGE COURSE EVERY COUPLE OF YEARS. THE COMMITMENT MUST BE STRONG ENOUGH TO WITHSTAND HARD TIMES AS WELL AS GOOD.

ENERGY POLICY IS NOT AN EASY ISSUE. EVERY DECISION HAS POWERFUL IMPACTS AND/OR TRADE-OFFS. THE QUESTIONS ARE NOT ONLY WHICH TECHNOLOGY BUT AT WHAT COST, WHAT EFFICIENCY, WHAT MAGNITUDE, AND AT WHAT ENVIRONMENTAL EXPENSE? NONE OF THESE ARE EASY QUESTIONS AND CERTAINLY THEY DO NOT HAVE EASY ANSWERS.

RECENT EVENTS TELL US ONE THING. WE CANNOT AFFORD TO THROW AWAY OR DISMISS ANY ENERGY TECHNOLOGY. WE NEED THEM ALL IN A BALANCED APPROACH TO MEETING OUR ENERGY NEEDS AS WE ENTER THE 21ST CENTURY. OUR POLITICAL SITUATION TODAY SHOWS US THE DANGER OF TOO MUCH DEPENDENCE ON A SINGLE IMPORTED ENERGY RESOURCE, AND YET OUR CURRENT PATH MAY BE LEADING US INTO EVEN MORE DANGEROUS CIRCUMSTANCES. WE MUST DEVISE OUR ENERGY INDEPENDENCE OURSELVES. AND WE MUST DO IT NOW.

I BELIEVE THE AMERICAN PUBLIC WILL SUPPORT AN ENERGY POLICY IF THEY UNDERSTAND IT AND BELIEVE THAT THE POLICIES ADDRESS THE UNDERLYING PROBLEMS. ALONG THIS LINE IF WE WISH TO GARNER PUBLIC SUPPORT WE MUST TRY TO MAKE SOME HEADWAY IN THE SHORT-TERM, EVEN AS WE SET LOFTIER GOALS FOR THE LONG-TERM. WE NEED TO SHOW RESULTS EARLY AND BE ABLE TO DEMONSTRATE PROGRESS AND SUCCESS THROUGHOUT THE YEARS IN ORDER TO KEEP THE PUBLIC INTERESTED AND TO MAINTAIN THE GRASSROOTS SUPPORT FOR THE LONG-TERM. WE CANNOT PREACH INDIVIDUAL SACRIFICE OR ADDED EXPENSE TODAY, IF THE PAYOFF WIL BE REALIZED WHILE ALWAYS HOLDING 20 YEARS IN THE FUTURE.

WHILE THE GOALS AND OBJECTIVES OF THE DEPARTMENT OF ENERGY'S STRATEGY ARE LAUDABLE, I CANNOT AGREE THAT THE ADMINISTRATION'S FY92 BUDGET REQUEST IS IN SYNC WITH THIS ENERGY PLAN. I LOOK FORWARD TO DISCUSSING THIS POINT OF VIEW AT LENGTH WITH THE DEPARTMENT DURING OUR AUTHORIZATION HEARINGS WHICH BEGIN NEXT WEEK.

I WISH TO THANK OUR PANEL OF WITNESS, ESPECIALLY CONGRESSMAN PANETTA; YOU HAVE ALL WORKED THESE DIFFICULT ISSUES FOR MANY YEARS. WE APPRECIATE YOUR WILLINGNESS TO SHARE YOUR INSIGHTS AND OPINIONS WITH US.

FINALLY, I COMMEND THE DEPARTMENT OF ENERGY FOR ITS EFFORTS TO TACKLE THIS DIFFICULT ISSUE. THEIRS WAS A THANKLESS TASK. I THINK WE ALL KNEW THERE WOULD BE MUCH DISSENT AND DISAGREEMENT WITH WHATEVER PLAN HAD BEEN DEVISED. FOR NEARLY TWO DECADES WE HAVE DEBATED AND ARGUED OVER ENERGY POLICY, WITHOUT RESULT. I WOULD HOPE THAT THIS STRATEGY WOULD SERVE AS A BASE UPON WHICH WE CAN FINALLY SHAPE A LONG-TERM STRATEGY THAT OUR NATION SO SORELY NEEDS.

THANK YOU, MR. CHAIRMAN.

OPENING STATEMENT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
NATIONAL ENERGY STRATEGY
FEBRUARY 28, 1991

Constance Morella

Mr. Chairman, I am eager to hear from my colleague, Leon Panetta, and the other witnesses today who bring a special expertise to the discussion of a national energy strategy. I am pleased with many elements of the National Energy Strategy: the increased participation of the federal government in technology transfer, especially the ability of the United States to copyright computer software; the promotion of renewable energy resources by extending the tax credit on solar and geothermal business; the reduction of oil consumption by the use of alternative fuel vehicles in commercial fleets and the encouragement of commuter van-pools and public transit by allowing tax-exempt commuter subsidies by employers; increased research and development for renewable technologies such as solar, wind, biomass and geothermal; increased research and development on innovative building materials and designs; and the improvement of precollege science and mathematics education.

However, I look for changes in some proposals. I would hope that instead of reliance on drilling, Americans would be encouraged to make changes in our energy use. I am grateful to have the thoughts of the witnesses today as to what they regard as essential elements in a comprehensive national energy strategy.

THE HONORABLE DON RITTER (R-PA)
OPENING STATEMENT
HEARING ON THE NATIONAL ENERGY STRATEGY
FEBRUARY 28, 1991

MR. CHAIRMAN, I COMMEND YOU FOR YOUR FORESIGHT IN HOLDING THESE HEARINGS, AS THE WAR IN THE MIDDLE EAST COMPELS US TO REEXAMINE OUR ENERGY POLICY. WE HAVE NOT YET BROKEN OUR DANGEROUS ADDICTION TO FOREIGN OIL. SEVENTEEN YEARS AFTER THE 1973 OIL SHOCK, WE STILL FIND OURSELVES FACING UNFORTUNATE DEVELOPMENTS IN THE ENERGY MARKETPLACE AS A RESULT OF OUR OVER-DEPENDENCE ON IMPORTED OIL -- VOLATILE OIL PRICES, DISRUPTION OF OUR ECONOMY, AND THE EVER-PRESENT POSSIBILITY OF AN OIL SUPPLY INTERRUPTION.

WE SHOULD FOCUS ON A NATIONAL ENERGY STRATEGY WHICH ADDRESSES OUR NATIONAL SECURITY, ENVIRONMENTAL CONCERNS, COMPETITIVE POSITION IN THE WORLD, AND INCREASING DEMAND FOR ELECTRICITY.

THERE ARE OBVIOUSLY MANY APPROACHES WE CAN TAKE -- AND IT IS IMPORTANT THAT WE HAVE A HEALTHY DISCUSSION ABOUT OUR ENERGY FUTURE. IT IS TIME FOR US TO FIND WAYS TO USE THE ENERGY WE HAVE MORE WISELY, AND INCREASE OUR RELIANCE ON SECURE DOMESTIC SOURCES OF ENERGY.

WE SHOULD NOT RELY ON ANY ONE APPROACH. INSTEAD, WE NEED A COMPREHENSIVE STRATEGY FOR SECURING OUR ENERGY INDEPENDENCE. WE SHOULD ENCOURAGE ENERGY CONSERVATION AND PERMIT REASONABLE EXPLORATION, DEVELOPMENT AND PRODUCTION OF DOMESTIC ENERGY RESOURCES TO THE MAXIMUM EXTENT POSSIBLE, WHILE COMPLYING WITH STRICT ENVIRONMENTAL SAFEGUARDS.

WE NEED TO MAKE PROGRESS ON ALL FRONTS: CONSERVATION AND ENERGY EFFICIENCY, RENEWABLE ENERGIES, GAS, OIL, COAL, AND NUCLEAR ENERGY. THE NATIONAL ENERGY STRATEGY CONTAINS IMPORTANT INITIATIVES TO MOVE US FORWARD.

WE ARE CONSISTENTLY URGED TO SEEK "CLEAN" ENERGY. BESIDES RENEWABLE ENERGY TECHNOLOGIES, MANY OF WHICH ARE STILL YEARS AWAY FROM WIDESPREAD USE, WE MUST CONSIDER ANOTHER OPTION. NUCLEAR POWER GENERATES VIRTUALLY NO AIR POLLUTION. IT HAS THE POTENTIAL TO BE A CONSISTENTLY SAFE AND RELIABLE SOURCE OF ENERGY, AND IT MUST BE INCLUDED IN THE FUTURE ENERGY MIX OF THIS COUNTRY.

WE ARE MAKING PROGRESS IN THE DEVELOPMENT OF ADVANCED NUCLEAR REACTORS WITH STANDARDIZED DESIGNS. STANDARDIZATION WOULD EXPEDITE THE LICENSING PROCESS AND ENSURE PUBLIC SAFETY. THIS WOULD PROVIDE UTILITIES, THEIR RATEPAYERS AND CONTRACTORS WITH PREDICTABILITY AND LOWER RATES IN THE LONG RUN.

IT IS MY HOPE THAT WE WILL SOON SEE BOTH A SUCCESSFUL WRAPUP OF THE CURRENT CONFRONTATION WITH IRAQ, AND A CONSENSUS FOR A STRATEGY THAT TAKES CONTROL OVER OUR ENERGY POLICY AWAY FROM THE DANGEROUS MIDDLE

EAST, AND PUTS IT BACK INTO OUR HANDS. ADMIRAL WATKINS HAS DONE A TREMENDOUS AND CREDIBLE JOB OF PUTTING TOGETHER A FRAMEWORK THAT WILL MOVE US TOWARD "ENERGY INDEPENDENCE." I LOOK FORWARD TO HEARING MORE FROM OUR WITNESSES TODAY ON THE NATIONAL ENERGY STRATEGY.

STATEMENT FOR THE RECORD

HON. LAMAR SMITH (R-TX)

NES HEARING

FEBRUARY 28, 1991

THANK YOU, MR. CHAIRMAN.

I WOULD LIKE TO EXPRESS MY CONCERNS THAT UNLESS WE TAKE IMMEDIATE ACTION TO INCREASE DOMESTIC OIL PRODUCTION IN THE LOWER 48 STATES, THE UNITED STATES WILL NOT ACHIEVE THE ENERGY SECURITY IN THE NEW TERM THAT IS THE GOAL OF THE N.E.S.

RENEWABLE ENERGY SOURCES, ALTERNATIVE FUELS, AND ENERGY CONSERVATION TECHNOLOGIES ARE LONG-TERM ANSWERS TO OUR ENERGY SECURITY. BUT WHAT IS MISSING FROM THE N.E.S. IS THE INCENTIVES FOR THE INDEPENDENT PRODUCERS THAT WILL KEEP THEM PRODUCING UNTIL WE CAN REACH THOSE LONG-TERM GOALS SET BY THE PRESIDENT.

NO ENERGY POLICY LEGISLATION WOULD BE COMPLETE WITHOUT THE INCLUSION OF TAX RELIEF FOR THE INDEPENDENT PRODUCERS.

OUR NATION'S INDEPENDENT OIL PRODUCERS DRILL 80% OF ALL EXPLORATORY OIL WELLS. BUT IT IS BECOMING MORE AND MORE DIFFICULT TO FIND INVESTORS. YET, WITHOUT THESE

INDEPENDENTS, WE WOULD LOSE 40% OF OUR DOMESTIC OIL PRODUCTION.

I URGE MY COLLEAGUES TO INCLUDE IN LEGISLATION ALTERNATIVE MINIMUM TAX RELIEF PROVISIONS FOR THE INDEPENDENT PRODUCER.

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Congress of the United States
House of Representatives

COMMITTEE ON BANKING, FINANCE AND URBAN AFFAIRS

COMMITTEE ON THE JUDICIARY

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

CO-CHAIRMAN, TASK FORCE ON TECHNOLOGY AND POLICY

CO-CHAIRMAN, TASK FORCE ON TOXICS

HOUSE COMPETITIVENESS CAUCUS

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CONGRESSIONAL HUMAN RIGHTS CAUCUS

ARMS CONTROL AND FOREIGN POLICY CAUCUS

CONGRESSIONAL CAUCUS FOR WOMENS' ISSUES

STATEMENT OF CONGRESSMAN TOM CAMPBELL
House Committee on Science, Space, and Technology

Hearing on National Energy Strategy
February 28, 1991

Mr. Chairman, thank you for convening this very important hearing today. I regret that pressing official business has prevented me from being here today, but I appreciate the opportunity to offer my statement.

Mr. Chairman, in any objective assessment of America's energy situation, two stark realities must be faced:
(1) Fossil fuels are heavy pollutants.
(2) Fossil fuels, once used, are gone forever.

Face those two realities, and it quickly becomes clear that America's long-term energy needs must be met with resources other than fossil fuels. The sooner we can move away from energy sources like coal and oil, the sooner we can ensure the long-term health of our environment and economy.

America simply cannot continue to rely on coal and oil -- especially foreign oil -- the way we have in the past. We in California know as well as any people in the country about the effect of fossil fuels on air quality. Though new technologies are allowing us to reduce the level of pollution from those fuels, they will never be as clean as wind or solar power.

The newly announced National Energy Strategy contains some incentives for alternative energies -- but not enough. The most significant proposal would require private fleets to acquire an increasing number of vehicles that run on fuels like ethanol and methanol, beginning with 10 percent of new vehicles by 1995.

In addition to making better use of alternative fuels in the transportation sector, we need to devote more resources to research and development in areas like geothermal, wind, hydrogen, and solar power. These energy sources are not only cleaner than fossil fuels, they are practically limitless; and they are especially promising for electricity generation. In my home state of California, alternative fuels already provide more than ten percent of electricity needs. Wind generation alone exceeded two billion kilowatt-hours in 1989, enough to power the residential needs of over 900,000 people. Impressive as this fact is, just one site in Browning, Montana, could provide 17 times that amount.

THIS STATIONERY PRINTED ON PAPER MADE OF RECYCLED FIBERS

The quickest, surest way to reduce our dependence on fossil fuels and foreign oil, however, is conservation, and here the National Energy Strategy needs improvement. A good start is made by the NES's allowing tax-free rebates for homes and businesses who make energy efficiency improvements. However, a significant omission is no increase in auto efficiency (CAFE) standards. Increasing CAFE standards to 45 mpg would save the equivalent of 11 billion barrels of oil over 20 years. Overall, conservation measures will continue to provide benefits as long as they are in place -- future advantages that new oil drilling operations cannot promise.

Many of the ideas that I have spoken of are included in H.R. 560, a comprehensive proposal I am honored to cosponsor with Congressman Leon Panetta. H.R. 560 creates the investment climate needed for the development of conservation measures and alternative fuels, and the bill takes major steps to improve America's energy security. I am delighted that our colleague Mr. Panetta is testifying before our committee today.

In the short term, of course, we must continue to rely on fossil fuels. To expect to move away from them completely in the next few years is not realistic.

But diminishing our reliance on fossil fuels can be our goal. The stark reality is that it is only a matter of time before our environmental and energy needs force us to find better solutions. Let's begin now by amending the White House plan to focus more on conservation and alternative energy sources.

APPENDIX V

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

AGA American Gas Association

1515 Wilson Boulevard, Arlington, Va. 22209
Telephone (703) 841-8621

Richard M. Irby III
Vice President
Government Relations

March 8, 1991

The Honorable Marilyn Lloyd
Chairman of the Subcommittee on Energy
Committee on Science, Space & Technology
B-374 Rayburn House Office Building
House of Representatives
Washington, DC 20515

Dear Madam Chairman:

On behalf of the American Gas Association I am enclosing the statement of our association for the hearing record on H.R. 560, the National Energy Policy Act of 1991, introduced by the Honorable Leon Panetta of California. Hearings were held on February 28, 1991.

We appreciate the opportunity to have the views of the American Gas Association made a part of the hearing record on this important matter.

Sincerely,

Rick Irby

Richard M. Irby III

STATEMENT OF
THE AMERICAN GAS ASSOCIATION
BEFORE THE COMMITTEE ON
SCIENCE, SPACE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
ON H.R. 560
THE NATIONAL ENERGY POLICY ACT OF 1991

February 28, 1991

Introduction

Mr. Chairman and Members of the Committee: The American Gas Association (A.G.A.) is a national trade association comprising some 250 natural gas distribution and transmission companies serving over 174 million natural gas consumers throughout the United States. We appreciate this opportunity to present our views on H.R. 560 as it relates to natural gas-related research, development and demonstration (RD&D) conducted or sponsored by the Department of Energy (DOE).

The American people recognize that greater energy security, improved air quality and energy efficiency are essential to a strong U.S. economy and helping us retain a competitive edge. Enactment of the Clean Air Act Amendments (CAA) and the various national energy strategy (NES) initiatives are a first step in reaching these goals. To define these goals further, the gas industry is proposing a 10 year RD&D program that truly supports the efforts and ideals laid out in the CAA and the NES. To inaugurate this program, the natural gas industry is recommending an authorization and appropriation of $214.9 million for all DOE gas-related RD&D in Fiscal Year (FY) 1992. This total is broken down as follows: $165 million for gas utilization R&D in both DOE's fossil energy and conservation programs, and $49.9 million for gas supply research in the fossil program. The primary thrust of this major expansion of natural gas related federally-funded research is to develop the technology that will allow natural gas to make a major contribution to the nation's environmental and energy security needs. Natural gas cannot fulfill its full potential without the proposed RD&D.

The Importance of Gas-Related Research

As an abundant domestic resource, natural gas can play a significant role in the nation's energy balance and has the potential to make a meaningful contribution in cleaning up the environment. Natural gas is our nation's cleanest burning fossil fuel -- its combustion emits virtually no particulates or sulfur oxides, and it produces far lower emissions of ozone precursors, carbon monoxide, and other pollutants per unit of energy than coal or oil. In addition, A.G.A. and the DOE National Energy Strategy estimate that natural gas could displace up to 1.7 million barrels of imported oil per day within 10 years. An A.G.A. analysis is attached. Intensified RD&D programs focused on gas utilization technologies appropriately backed by continuing gas supply RD&D must be undertaken in order to expedite and expand this schedule and derive the accompanying environmental benefits. The gas industry recommends that Congress and DOE undertake a long-term (10-year) natural gas RD&D program funded at $2.5 billion to augment the planned industry funding. Programs should include: stationary emissions and efficiency solutions; transportation fuel alternatives and emissions solutions; electrochemical energy conversion; and gas supply enhancement. A comprehensive 10 year program is necessary to provide a level of consistency in research efforts that can support projects through to their completion and commercialization.

To initiate these programs we recommend that this Committee authorize $214.9 million in FY 92 for natural gas RD&D. These funds should be allocated as follows: (1) $165 million for natural gas utilization programs to accelerate the availability of new technologies and reap the associated environmental, energy security and conservation benefits. $49.9 million is needed to support a continuing natural gas supply RD&D program. This will supplement gas industry, gas equipment manufacturer, and producer efforts with estimated funds in the range of $200 million and $215 million in FY 92 for utilization and supply, respectively.

This natural gas industry initiative requires funding only for those technologies that are essential and prudent for the orderly development of advanced and new gas utilization and supply methods and processes that will enhance greater energy security, improved air quality and energy efficiency. Recent events in the Middle East underscore the need for better utilization of our nation's indigenous resources. This recommendation for a total amount of $214.9 million is required because of the increasing urgency to promote low pollution end-use technologies and fuel efficiency. This in turn will help meet more ambitious national objectives that will take us into the 21st Century.

H.R. 560

We are pleased that Mr. Panetta and the cosponsors of the National Energy Policy Act of 1991 are proposing to authorize funds for energy research and development that are intended to increase America's energy security in ways that are environmentally desirable and economically affordable. While the sums authorized are quite large, the bill does not prescribe how this money should be spent. In addition, the gas industry believes there are other energy research and development programs that need to be funded by the federal government to enhance energy security, such as combustion technology and gas cooling. Therefore, we urge this Committee to include in H.R. 560 the gas industry's RD&D initiative, described above and further outlined below, to carry out the goals of the bill. Unless specific programs are more clearly defined, we are unlikely to achieve the desired energy security, energy efficiency and environmental results.

We also believe it is imperative that members of the Committee work closely with the Appropriations Committee to assure that these programs are brought to fruition. There is a striking imbalance between the amount of natural gas used in the United States and the amount of RD&D funding natural gas receives. Natural gas supplies about 23 percent of America's energy needs, yet the federal government spent just over $117 million for FY91 on gas-related R&D, out of a total DOE R&D budget of approximately $1.8 billion. In contrast, nuclear power provides about 7 percent of the nation's energy and received over $503.2 million, while coal supplies 25 percent of the energy and received about $680 million in FY91. Please understand we are not attempting to identify or recommend the source of funds needed to meet the increased federal funding for natural gas RD&D.

The natural gas industry advocates that the private and public sectors share responsibility for funding RD&D. Where feasible, market incentives drive RD&D funding by an industry. However, in the case of secure energy, a clean environment and energy life-cycle efficiency markets do not adequately recognize those benefits that accrue to the nation as a whole. This results in lack of industry funding at the conceptual and proof of concept stages for viable technologies. This early life-cycle stage is where government must recognize its long term responsibilities by heavier than normal participation in the RD&D process. It has to be understood by government that by achieving a balance in energy technology choices the nation as a whole benefits, not just the direct users of the technology.

Traditionally, the R&D phases are the lowest component of the total path from basic research to successful commercialization. When a product progresses to the stage where the technology is ready to be transferred from the laboratory into the commercial market -- that is the logical point that industry takes on a higher percentage of funding. Therefore, legislation must not predetermine the federal share of the cost of a project at any particular stage in its development.

Specific Funding Recommendations*

GAS UTILIZATION R&D: $165.0 MILLION

(1) Fuel Cells ($62.0 million)

Natural gas-powered fuel cells convert the energy content of gas directly into electricity and by-product heat using a highly efficient electrochemical process. The electrical conversion efficiency of gas-powered fuel cells is approximately 15-20 percent greater than the conversion efficiency of traditional electrical generation. Fuel cells are also environmentally benign, generating very little noise and vibration, and emitting virtually no pollutants.

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*Funding amounts listed are for FY 1992.

A total of $38.5 million should be used to support accelerated RD&D for molten carbonate fuel cells and $10.5 million should be used for accelerated and focused development of solid oxide fuel cells technologies. Furthermore, $2.0 million should be allocated for intensified development of solid polymer (proton exchange membrane) fuel cell technology. This is a promising new approach to the development of fast-response, compact fuel cells with low temperature heat rejection, suitable for electric power generation in stationary as well as mobile use. An additional $2.0 million should also be allocated to applied fuel cell research covering projects aimed at using solid polymer cell concepts in small-scale electric power generation, and projects that seek to improve the reliability and life of critical fuel cell components. We also recommend a vigorous technology transfer program for phosphoric acid fuel cells funded at $9 million.

(2) Heat Engines ($6.9 million)

A.G.A. recommends an RD&D program in DOE's Heat Engine Program for the development of high efficiency natural gas-powered turbines for electric generation. Such a program should include advanced combined cycle turbines, steam-injected gas turbines (STIG) and intercooled steam-injected gas turbines (ISTIG). The ISTIGs, in particular, are approximately fifty percent more efficient than conventional powerplants, cost half as much as new coal or nuclear plants and can make great contributions to the nation's air pollution problems.

(3) Coal and Waste Cofiring/Reburn ($8.5 million)

Cofiring of coal with natural gas provides a fraction of its total heat input and results in significant SO_2 and NO_x reductions. Reburn technology is aimed primarily at reducing powerplant NO_x emissions. Unlike cofiring, reburn technology injects natural gas into a zone beyond the primary combustion zone to create a gas rich reburn zone. Combining reburn with sorbent injection results in both NO_x and SO_2 reductions.

Cofiring technology applications to industrial processes and waste-to-energy plants have not yet been addressed. Developments in these areas are at the early stages, but will require significant funding to support technology advancements. We therefore recommend $8.5 million for coal and waste cofiring and reburn applications.

(4) Combustion System/Emission Control ($17.8 million)

Because of the importance of this program to the nation as part of its energy strategy and in response to recently-adopted Clean Air Act legislation, $17.8 million is needed to accelerate and focus combustion and burner RD&D efforts aimed at developing low emissions gas equipment for residential, commercial, industrial, and utility applications. This includes high-efficiency, low-emissions burners, burner systems, and new methods of post-combustion control for new as well as retrofit installations.

Our recommendation includes: $6.0 million for the development of new methods of post-combustion emissions control that will promote the search for practical, low-cost solutions to typical retrofit/add-on needs of electric generation and industrial process facilities; $5.3 million for co-funding accelerated research specifically focused on utility electric generation (UEG) and enhanced oil recovery (EOR) operations using natural gas combustion equipment; and $6.5 million for the residential/commercial end-use sector.

(5) Natural Gas-Powered Heat Pumps and Desiccant Cooling ($18.0 million)

The gas heat pump provides heating and cooling in a single unit, using less energy than a conventional or high efficiency furnace uses for heating alone. Current performance estimates suggest that in heating, the gas heat pump could save one-half of the gas used in a conventional furnace and one-quarter of the gas used in a high efficiency furnace.

Development of this equipment could greatly reduce the need for peak electric generating plants. More research is necessary to develop highly-efficient, reliable and cost-effective gas heat pumps for residential and commercial applications.

(6) Industrial Processes ($18.8 million)

We recommend $7.8 million to demonstrate newly developed processes in real-world industrial environments, not laboratories. Several innovative concepts, which promise to revolutionize the manner in which process heat is generated in the industrial sector, are under development and will be available for technology transfer within the next two years. Applied RD&D efforts, funded at $4.0 million by DOE are also proposed to improve efficiency, productivity and product quality in industrial gas-fired equipment and processes through the application of advanced combustion, heat transfer and controls technology. The gas industry is also recommending that $6.0 million be allocated for research and development focused on low emissions of natural gas combustion equipment for this sector. These funds will cover activities to help extend application of technologies employed in UEG/EOR end-use sectors to industrial processes and to obtain fundamental understanding on the formation and recombination of pollutants.

Continuing ceramic material RD&D funded at $1 million is also needed to address several technical issues that have impeded wide market penetration.

(7) Natural Gas Vehicles (NGVs) ($27.0 million)

Use of alternative-fuel vehicles, including NGVs, is being required by the Clean Air Act and various National Energy Strategy initiatives. Accelerated research on novel gas compression concepts, funded at $10 million, is required to advance the development of compressor technology that will facilitate the growth of the necessary natural gas refueling network. Research must also be conducted on advanced storage systems, such as sorbent materials, to increase the understanding of gas storage technology, particularly the fundamental principles of natural gas adsorption, absorption, clathration and catalysis.

In addition, $15 million in DOE funding is also needed to conduct accelerated technology transfer on a variety of NGVs in many medium and heavy duty applications. To be most effective, such technology transfer activity requires that the government purchase and operate NGVs for its fleet.

(8) Advanced Research & Technology Development (ARTD) ($6.0 million)

The Advanced Research and Technology Development program generally supports basic research in combustion chemistry, engineering concepts, advanced process development, and materials and components that provide a technology base for ongoing fossil energy projects. Current research needs include: development of advanced high-temperature materials capable of resisting chemical attack from sodium and chlorine for application in glass and aluminum melting; development of inexpensive and durable catalysts to bring natural gas catalytic combustion closer to practical implementation;

improving the understanding of the interaction of gasification catalysts with carbon/steam and carbon/hydrogen reactions; developing advanced processes for low-cost synthesized gas; developing lower-cost acid-gas cleanup processes; continuation of efforts to assess advanced cleanup technology for alkali metals, particulates and tars; and biological and catalytic production of high-value chemicals.

GAS SUPPLY RD&D: $49.9 MILLION

DOE's continuing involvement in gas supply research is essential to ensure the recovery of a larger percentage of the total domestic gas resource base. Our recommendation of $49.9 million for FY 92 shows no increase above the industry's recommended FY 91 funding levels and is predicated on the continuation of the gas supply research programs recommended for FY 91.

The amount of gas that can be recovered from the total gas resource base is directly contingent upon the ability to develop new tools and techniques to recover this gas at commercially viable prices. This resource base is made up of reserves and resources. The recovery of gas in the "resources" category requires discovery and development of **new** technology on the basis of an improved understanding of reservoir geology. Of the total resource evaluated in the lower-48 states 564 Tcf is judged economically recoverable at 1987 wellhead prices of less than $3/Mcf. An additional 131 Tcf of gas is judged economically recoverable in a price range of $3 to $5/Mcf.

(1) Unconventional Natural Gas ($23.8 million)

Devonian shales and tight sands are estimated to contain up to 1,800 Tcf and 900 Tcf of natural gas, respectively. Tight formation gas is produced using advanced recovery techniques, such as hydraulic fracturing. A.G.A. estimates that favorable economic conditions and substantial investment in advanced recovery techniques could increase the accessible gas resources and improve the economics of production.

In order to maximize the amount of natural gas recovered from our abundant resource base, basic geoscience research must be expanded. This research should be aimed at increasing our knowledge of the geological/geochemical/geophysical characteristics and parameters of both conventional and unconventional formations. Moreover, because of the potentially enormous size of what we call advanced unconventional natural gas resources, extensive research is necessary to verify how much may be technologically and economically recoverable.

To enhance the development of technology necessary to recover the gas from unconventional gas formations, more research must also be conducted to develop and refine advanced stimulation and drilling techniques. Field testing and a technological database must also be established. We are recommending funding of $23.8 million in the unconventional gas recovery program to continue DOE's secondary gas recovery program and ongoing research activities in western tight stands, Devonian shales, and other complex formations and to support expanded geoscience-type research.

(2) Surface Coal Gasification ($8.5 million)

For surface coal gasification to make a significant contribution to gas supplies, gasification techniques must be developed to accommodate high-sulfur Eastern coals and combustion-inhibiting coal "fines." Research must be conducted to develop techniques for gasifying these "fines," for disposition of liquid byproducts, and for consolidated "fines" and tars for utilization. Scientific and engineering feasibility studies of advanced generation gasification processes must also be conducted to develop a technological database for such processes.

(3) Geopressured Methane ($9.6 million)

Geopressured methane is found in either a free state or dissolved in water and trapped in sedimentary rock at higher-than-normal pressures. One of the largest geopressured areas underlies a portion of the Texas and Louisiana Gulf Coast. Estimates of the total resource in-place range up to 6,000 Tcf; however, estimates of the amounts of gas that might ultimately be recovered, given current recovery techniques, range between 10 and 150 Tcf. If technological breakthroughs can be achieved, geopressured methane could become another major source of domestic energy.

Research conducted by DOE in geopressured/geothermal zones is focused on producing both gas and electricity from low-grade heat in the reservoir brine. DOE should redirect its research efforts and concentrate on recovering the vast amount of dissolved methane found in geopressured zones. In addition to DOE's current geopressured program, DOE should develop new approaches that utilize traditional engineering principles to maximize gas production and minimize brine production.

(4) Biofuels ($8.0 million)

Since the supply of organic and waste materials is virtually unlimited, supplemental methane supplies from biomass and waste conversion can add significantly to the total future gas supply picture. In addition, controlled production and use of methane from these sources can reduce the natural release of methane from the decay of these waste materials. This decay is a substantial contributor to the overall rate of methane emissions to the atmosphere that contribute to the greenhouse effect. Finding sites for disposal of municipal solid waste is an increasing problem in communities across the nation. Therefore, developing energy from municipal solid waste and other biomass would promote the environmental benefit of productive use of currently "useless" materials. However, the quality of the gas produced and a suitable processing technique are important concerns that inhibit the widespread use of these potential gas resources.

The gas industry fully supports the gas-related biofuels R&D being carried out at the Solar Energy Research Institute (SERI) and recommends strong federal support for continuation of these important activities. Advances have been made in both the thermochemical and biochemical conversion processes, but more extensive studies and technology advancements are necessary to fulfill biomass' contribution as a usable source of energy.

Conclusion

The natural gas industry recognizes the continuing budget deficit places severe constraints on federal energy research dollars. However, increasing natural gas RD&D will more equitably match the contribution natural gas supplies to the nation's energy mix and will yield both short- and long-term environmental and energy security benefits for the nation.

DOE FY 1991 & 1992 Gas-Related Budget
Major Gas-Related Supply and Utilization Research Programs
($ Millions)
(As of 2/12/91)

	FY 1990 Congress. Approp.	FY 1991 DOE Request	FY 1991 Gas Industry Recomm.	FY 1991 Congress. Approp.	FY 1992 DOE Request	FY 1992 Gas Industry Recomm.
Gas Supply						
Unconventional Natural Gas	14.6	13.7	23.3	15.97	8.0	23.8
Surface Coal Gasification	23.7	8.5	8.5	15.12	5.4	8.5
Underground Coal Gasification	0.8	0.5	0.5	.794	0.0	0.0
AEPT*	4.0	4.5	-	4.67	3.0	-
Biofuels	8.6	2.5	8.0	4.6	6.3	8.0
Geopressured Resources	6.0	2.9	9.6	6.0	2.5	9.6
Subtotal	57.7	32.6	49.9	47.15	25.2	49.9
Gas Utilization						
Fuel Cells (Gas Related)	30.1	7.1	40.5	36.02	22.4	62.0
Heat Engines	0.0	0.0	2.9	0.0	0.0	6.9
Combustion--Cofiring/Reburn	2.5	0.0	8.5	0.0	0.0	8.5
Combustion--System/Emiss. Cont.	0.0	0.0	0.5	0.0	0.5	17.8
Conservation (Heat Pumps, Cooling, Industrial Processes)	25.4	17.8	16.8	25.1	16.7	36.8
Natural Gas/Diesel Vehicles	2.5	4.0	10.6	5.5	12.5	27.0
ARTD (Gas Related)	4.7	3.9	6.0	3.9	1.0	6.0
Subtotal	65.2	32.8	85.8	70.52	53.2	165.00
TOTAL	$122.9	$65.4	$135.7	$117.67	$78.3	$214.90

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*Advanced Extraction and Process Technology - Geoscience research has traditionally been folded into this line item.

AGA American Gas Association

Planning & Analysis Issues

Issue Brief 1991-3 . January 16, 1991

The Role of Natural Gas in Offsetting Oil: 1991 Update

A. Introduction

The invasion of Kuwait in August has brought the subject of U.S. dependence on oil imports to the forefront again. America now imports about half of the oil that it consumes. Most oil is used in the transportation sector, however, a large volume of fuel oil is also used in stationary applications: for space heating; for industrial process and boiler use; and for electricity generation. Oil use in stationary applications (excluding feedstocks) in 1989 amounted to 4.9 million barrels per day (b/d), or the equivalent of 68% of annual crude oil imports. Distillate and residual fuel oil, the oil products most likely to be offset by gas, make up half of that total. In contrast, natural gas is essentially a domestic resource with over 40 years of conventional supply under current consumption rates and the potential to extend the resource base well beyond the next century.

The purpose of this analysis is to demonstrate the extent to which natural gas can directly contribute to national energy security by substituting for oil in existing applications. This study updates a similar analysis published by A.G.A. in 1988. This analysis was prepared on a market-by-market basis over different time horizons: 30-day (immediate); 1 year; 5 years; and a 10-year potential. This analysis estimates oil displacement potential - it is not a forecast. Such levels would only be achievable if government policy actively promotes natural gas.

B. Executive Summary

In an emergency or oil supply disruption scenario natural gas could immediately offset 130 thousand barrels per day (mbd) of distillate and residual fuel oil in stationary applications. Within a year the rate of displacement could increase to 420 mbd as significant penetration in the dual-fuel capable boiler markets accumulates. After five years, the combination of growing conversions in the residential and commercial buildings sector (mainly on the East Coast) and further penetration in boiler and process markets would raise the penetration rate to 1.0 million b/d. If a comprehensive government initiative was begun now with a 10-year horizon, it is estimated that 1.5 million b/d of fuel oil use could be offset by the end of the decade. Adding 240 mbd that would, in effect, be offsets of gasoline use in fleet vehicles in the transportation sector, would bring total oil displacement by natural gas to 1.7 million b/d after 10 years.

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An important component of this initiative would be increased natural gas pipeline capacity into oil-dependent regions. The volume of current planned natural gas pipeline capacity would go substantially toward accomodating the projected level of oil displacements over five years. To achieve the ten year goal, a similar increment in pipeline capacity and an increase in gas storage capacity would be needed. The exact size of the increment is dependent upon seasonal load factors and upon the volume of additional gas load that would derive from economic growth and other new sources.

The highlights for each stationary market and for the transportation sector for each succeeding timeframe are as follows and summarized in Table 1:

- The residential market for fuel oil is essentially distillate oil use concentrated on the U.S. East Coast, particularly in the Middle Atlantic census division which accounts for 5.6 million of the 11 million oil-heated households. Conversions from oil to natural gas heat already comprise the single largest source of residential conversions annually. Based on previous conversion growth rates it is possible to envision 350,000 conversions in the first year, displacing 20 mbd, rising to 500,000 conversions annually by the fifth year, resulting in oil offsets of 100 mbd after five years. If the annual rate of conversions then holds at 500,000, the cumulative potential impact after 10 years would be the displacement of 225 mbd of distillate fuel oil use -- roughly half of the current consumption level. This ten year goal would require additional pipeline and storage capacity and distribution mains given the seasonality and location of this load.

- In the commercial market, both distillate and residual fuel oil are used - primarily for spaceheating, but also for water heating in large multi-family buildings. Similar to the residential sector, commercial fuel oil consumption is also concentrated on the East Coast, but to a lesser extent. In the event of an oil supply disruption, displacement of oil use in dual-fuel boilers could reach 25 mbd. After a year, the displacement of all oil in gas-served buildings, as well as in a portion of the more than three million multi-family units with gas service nearby, would increase the offsets to 100 mbd. With increased penetration in the multi-family sector, the offsets could reach 190 mbd after five years and as much as 250 mbd after 10 years. or nearly 65 percent of the current level of commercial fuel oil use.

- The industrial market is the largest stationary market for fuel oil. Even after discounting those oil applications for which natural gas is not suited for displacement (such as feedstocks, asphalt and vessel bunkering) there remains nearly 900 mbd of distillate and residual fuel oil use in boiler and process applications that theoretically could be displaced by natural gas. Oil offsets could rise from 50 mbd in the immediate term to 200 mbd after a year. This would occur predominantly in dual-fuel boiler applications where gas and residual oil, in particular, are intensely competitive. After five years, when gas penetrates more into the applications using distillate oil, the offsets are projected to increase to 400 mbd. If there is, in fact, a policy designed to minimize the use of oil in industrial applications, the extension of gas service to a high proportion of what had formerly been unserved customers could potentially see the level of offsets reach 600 mbd after 10 years. While certainly a large volume, this would only be about 15 percent of all the oil consumption (including LPG) in the entire industrial market and two-thirds of the residual/distillate oil use. Like the residential and commercial sectors, displacement of oil in the industrial market to meet the ten year goal will require significant new construction of pipeline and distribution infrastructure. Seasonal service arrangments would also have to be enhanced.

- Fuel oil consumption (almost entirely residual oil)in the electric utility market is heavily concentrated on the East Coast. Over 80 percent of this oil consumption occurs in the three census divisions along the Atlantic. Unlike the industrial market, which is made up of thousands of customers and more widely distributed, the number of power plants involved is relatively small. About 125 of the 290 or so power plants that use fuel oil are on the East Coast -- and some of these plants are already dual - fuel capable. Consequently, the potential for oil offsets rises quickly from 50 mbd in the very short - term to 300 mbd after five years. With a concentrated national effort, three - quarters of fuel oil consumption could be offset in 10 years, reaching 400 mbd. Given the location of these plants, it is likely many plants would choose to be dual-fuel capable, interruptible gas customers. Thus complete displacement of oil year-round would be unlikely.

- In the transportation sector the displacements would be limited in the early years, reflecting the fact that a natural gas vehicle (NGV) manufacturing and fuel distribution infrastructure is now beginning to develop. The oil displacement rate would move up from minimal levels in the first five years, rising quickly by the end of the decade to 240 mbd as 2 million centrally-refueled fleet vehicles in major urban areas convert to natural gas. The passage of the Clean Air Act of 1990 alone will spur oil offsets in the transportation sector.

Table 1

Potential Oil Substitution
(thousand barrels/day)

Stationary Sources	**Immediate**	**One-Year**	**Five-Years**	**Ten-Years**
Residential	5	20	100	225
Commercial	25	100	190	250
Industrial	50	200	400	600
Electric Generation	50	100	300	400
Subtotal	**130**	**420**	**990**	**1475**
Mobile Sources				
Vehicles	-	-	5	240
Total	**130**	**420**	**995**	**1715**

Note: NGV market penetration grows dramatically after five years as a result of the new Clean Air Act legislation which begins to take effect in 1995. A.G.A. forecasts that by the year 2005 natural gas vehicles could displace as much as 675 mbd.

THE NEW YORK TIMES, SATURDAY, FEBRUARY 23, 1991

IN THE NATION

Tom Wicker

A Foolish Decade

As U.S. forces roll toward military victory over Iraq, President Bush's high approval rating seems unlikely to be shaken by his cool response to the Soviet peace plan. When combat ultimately winds down, however, and patriotic fervor begins to fade, the U.S. public may begin to recall two circumstances, among others, that helped bring on the Persian Gulf war:

- For 10 long years before the Iraqi invasion of Kuwait, with Ronald Reagan in office for eight and George Bush for two, their Administrations actively assisted the now-hated Saddam Hussein in his war with Iran and his rise to a position of dominance in the Middle East; in the last days before he attacked Kuwait last August, the Bush Administration gave him a green light by specifically informing him that the U.S. had no interest in Middle East border disputes.
- For the same 10 long years, the Reagan and Bush Administrations systematically dismantled the extensive energy conservation and other policies instituted by Presidents Nixon and Carter following the oil shocks of the 1970's; as a result, when Saddam Hussein posed a new threat to Middle East oil supplies, the U.S., in the Reagan-Bush years had achieved nothing approaching energy independence and had hardly even tried.

Mr. Carter, with largely unrecognized prescience, had called the effort for energy independence "the moral equivalent of war." Mr. Reagan and Mr. Bush, with largely unrecognized myopia, pursued a course that gave Mr. Bush one reason — oil supplies for the West and Japan — for engaging in real war.

Energy myopia instead of energy independence.

Now, in the midst of a war at least partially fought for foreign oil, Mr. Bush has produced an energy policy that demands no energy conservation, asks no consumer sacrifice, imposes no energy taxes, sees no threat in heavy reliance on imported oil, pursues little real reduction in oil consumption, makes only faint efforts to achieve cleaner air and puts at environmental risk the Arctic National Wildlife Refuge, which would be opened to oil drilling and production.

Yet, all the oil likely to be found in the wildlife refuge is far less than could be realized from strong U.S. conservation measures. Worldwide, in the next decade, enough energy could be saved by higher automobile gasoline mileage alone to double agricultural production in the third world — a savings that can't possibly be realized unless the U.S. takes the lead.

Based on the record of a foolish decade, and Mr. Bush's proposals for the next, that's not likely. U.S. oil consumption has increased, and imports have doubled, from 4.3 million barrels a day in 1985 to more than 8 million just before the Iraqi invasion of Kuwait. That increase alone almost equals the total lost by the world market owing to the invasion and the subsequent embargo on Iraq.

Even with additional domestic oil production — the Bush Administration's shortsighted substitute for conservation and alternative fuels — the President's proposed new policy would rely on imports for 45 percent of the gargantuan U.S. oil consumption that he still would permit.

No wonder Senator Albert Gore of Tennessee termed the Bush plan "breathtakingly dumb." No wonder Wilfrid Kohl, director of the energy program at the Johns Hopkins School of Advanced International Studies, termed it "terribly mistaken."

An energy bill offered in the House by Representative Leon Panetta of California and 25 other Democrats is both more demanding and more promising. Among other things, it would raise automotive fleet mileage targets, increase Federal energy research spending, particularly on alternative and renewable sources, offer inducements to utilities and their consumers to promote energy conservation and impose an innovative gasoline tax that would take effect only as crude oil prices might decline. A conservation ethic would be maintained and domestic producers would be protected from oil-import price declines by a $16 per barrel floor price.

Experts no doubt can find fault with the Panetta bill; some may demand additional or tougher measures. But it's at least an attempt to make up for what Mr. Panetta called the "sad and frustrating example of a nation ignoring the lessons of history."

In sharp contrast, President Bush's continuing energy myopia raises the hard question whether the sacrifices and bloodshed of Desert Storm may have to be undertaken anew, when some future oil crisis finds the U.S. still dependent on hostile potentates, far-off sheikdoms and its own gas-guzzling addiction.

National Energy Policy Act (NEP) Summary

1) Strategic Petroleum Reserve - The bill would authorize the development and fill of a 2 billion barrel SPRO, with the fill above one billion barrels being dependent on the availability of "leased oil," or revenues from the taxes below. We now have 590 million barrels and the bill strongly encourages that the fill be acquired quickly, as soon as oil markets weaken after the Iraq crisis is over.

2) Western Hemisphere Energy Cooperation - The bill calls for a report from the President by December 1, 1991, to propose specific ways to cooperate with these countries, (particularly Mexico and Venezuela) to develop more oil production capacity in them. It asks for specific recommendations for U.S. assistance, including loans, price guarantees, and political risk insurance for the countries as well as the U.S. private sector.

3) A $16 a barrel floor price on domestic on-shore produced oil. Whenever imported oil prices dipped below $16 a barrel, a variable tax on all oil to refineries and imported products, would be triggered with an exemption for domestic on-shore production. The bill would not give floor price protection to OCS produced oil or oil produced from Federal or State lands that will be competitively leased after enactment. The President could exempt up to 100% of a baseline period's oil imports from Western Hemisphere countries such as Canada, Mexico and Venezuela to help promote Western Hemisphere Energy Cooperation.

4) Alternative Fuel Vehicles - DOE would be given $75 million in fiscal year 1992, rising to $150 million by fiscal year 1995, to help State and municipal agencies, mass transit agencies, and private sector vehicle fleets, buy new vehicles with alternative fuel capability (compressed natural gas, methanol, electricity or other). The Federal Government would be required to purchase an increasing percentage of its vehicle fleets (10% in FY 95 increasing to 60% in FY 2000) as alternative fuel capable vehicles.

5) Energy R&D Funding - Authorizes an increase of $171 million (75%) by FY 1994 for energy conservation R&D, an increase of $200 million (87%) by FY 1996 for solar energy R&D, and FY 1996 increases of $37 million (82%) in fuel cell R&D and of $24 million (89%) in enhanced oil recovery R&D.

6) New Federal Energy Management Plan - Federal agencies would be required to submit energy conservation proposals to DOE, and DOE could make loans to these agencies starting at $50 million in FY 1992 and rising to $100 million a year in FY 1993.

7) Low-Income Weatherization and Schools and Hospitals Conservation Grants - authorizes a $200 million weatherization increase by FY 1994, and $19 million by FY 1993 for schools and hospitals.

8) An Amendment to PURPA to require all state public utility commissions to consider enacting energy conservation incentive plans similar to those implemented by the New York and California PUC's. If adopted by the PUC's, these would require their utilities to give their customers incentives to conserve energy, and allow the utilities to profit from doing so.

9) Exempt from taxation payments made by utilities to consumers for energy and water conservation measures.

10) Standby Contingency Gasoline Conservation Tax. The tax could only go into effect when the price of crude oil in the future fell below the average real price of crude oil during a period before enactment. The tax generally would be set at one-half of that decline in the price of crude oil.

Thus, the tax should start small and grow slowly, and could only grow if and when crude oil prices fell sufficiently, and then, by no more than one-half of the decline. If and when the tax increased it generally would not raise gasoline prices, rather keep them from falling as much as they otherwise would.

The tax will be set initially at one tenth of one cent per gallon in FY 1992, and two tenths of one cent in FY 1993-96 to pay for the tax cuts given to consumers who will receive payments from utilities for adopting energy and water conservation measures.

11) CAFE auto efficiency targets. This would require a 20 percent improvement in each company's efficiency by 1996, and 40 percent by 2001.

APPENDIX VI

QUESTIONS AND ANSWERS FOR THE RECORD

GEORGE E. BROWN, Jr., California, CHAIRMAN

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RADFORD BYERLY, Jr.
Chief of Staff
MICHAEL RODEMEYER
Chief Counsel
DAVID D. CLEMENT
Republican Chief of Staff

March 12, 1991

The Honorable Leon Panetta
U.S. House of Representatives
Washington, D.C. 20515

Dear ~~Congressman Panetta~~ Leon:

Thank you for your excellent testimony at our February 28, 1991 hearing on the National Energy Strategy.

Should you have any supplemental remarks for the record of the hearing we would appreciate receiving them within three weeks from the date of this letter. Please forward this information to the Subcommittee on Energy office, B-374 Rayburn House Office Building, Washington, D.C. 20515, to the attention of Kathryn R. Holmes.

I appreciate your cooperation in this matter.

Sincerely,

George

GEORGE E. BROWN, JR.
Chairman

GEB:cf

[illegible]

[illegible]
Chief of Staff
[illegible]
Chief Counsel
[illegible]
Republican Chief of Staff

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March 12, 1991

Mr. S. David Freeman
General Manager
Sacramento Municipal Utility District
P.O. Box 15830
Sacramento, CA 95852-1830

Dear Mr. Freeman:

Thank you for your excellent testimony at our February 28, 1991 hearing on the National Energy Strategy.

We would like to supplemment the record of the hearing with your responses to the attached questions. We would appreciate receiving your responses within three weeks from the date of this letter. Please forward this information to the Subcommittee on Energy office, B-374 Rayburn House Office Building, Washington, D.C. 20515, to the attention of Kathryn R. Holmes.

I appreciate your cooperation in this matter.

Sincerely,

George E. Brown Jr.

GEORGE E. BROWN, JR.
Chairman

GEB:cf

Questions For The Record
Mr. S. David Freeman, General Manager
Sacramento Municipal Utility District

March 11, 1991

1. There seemed to be a general theme among most panel members that if we are to be successful in coming to grips with our energy problems then we, as a nation, must make a long-term commitment. I would appreciate your thoughts on how we might get a long-term commitment by the general public to take the steps necessary to do the job. Are there measures that can be taken in the short run to initiate and retain public commitment?

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MICHAEL RODEMEYER
Chief Counsel
DAVID D. CLEMENT
Republican Chief of Staff

March 12, 1991

Mr. Mark Singel
Lieutenant Governor
State of Pennsylvania
116 Pine Street, Second Floor
Harrisburg, Pennsylvania 17101-1227

Dear Mr. Singel:

Thank you for your excellent testimony at our February 28, 1991 hearing on the National Energy Strategy.

We would like to supplemment the record of the hearing with your responses to the attached questions. We would appreciate receiving your responses within three weeks from the date of this letter. Please forward this information to the Subcommittee on Energy office, B-374 Rayburn House Office Building, Washington, D.C. 20515, to the attention of Kathryn R. Holmes.

I appreciate your cooperation in this matter.

Sincerely,

George E. Brown Jr.

GEORGE E. BROWN, JR.
Chairman

GEB:cf

Questions for the Record
Honorable Mark Singel, Lieutenant Governor
State of Pennsylvania

March 11, 1991

1. You mentioned that the State of Pennsylvania has a number of research and development projects underway in the energy area. In particular you noted the efforts in the use of hydrogen for fuel cells and for direct use. We would be interested in learning more about these programs including information on the level of R&D investment, cost-sharing with industry and technical progress to date.

2. Also, we would be interested in your opinions as to how federal and state government R&D programs could be enhanced in terms of coordination, demonstration or in other aspects.

3. There seemed to be a general theme among most panel members that if we are to be successful in coming to grips with our energy problems then we, as a nation, must make a long-term commitment. I would appreciate your thoughts on how we might get a long-term commitment by the general public to take the steps necessary to do the job. Are there measures that can be taken in the short run to initiate and retain public commitment?

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Republican Chief of Staff

March 12, 1991

Dr. John Gibbons, Director
Office of Technology Assessment
Washington, D.C. 20510-8025

Dear Dr. G[illegible] Jack

Thank you for your excellent testimony at our February 28, 1991 hearing on the National Energy Strategy.

We would like to supplemment the record of the hearing with your responses to the attached questions. We would appreciate receiving your responses within three weeks from the date of this letter. Please forward this information to the Subcommittee on Energy office, B-374 Rayburn House Office Building, Washington, D.C. 20515, to the attention of Kathryn R. Holmes.

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Sincerely,

George

GEORGE E. BROWN, JR.
Chairman

GEB:cf

Questions For the Record
Dr. John A. Gibbons, Director
Office of Technology Assessment

March 11, 1991

1. In response to questions, you mentioned that there were significant differences in the estimates of CAFE impacts between your assessment and DOE's model. Would you specifically identify those differences and provide an explanation of why the two methodologies (DOE's vs. OTA's) produce different results.

2. In the discussion you noted that United States investment in technologies for alternative fuels and energy efficiency paid dividends in the early and mid 1980's. You also mentioned that in the 1980's we stopped making such investments and are now seeing the results. Is there specific evidence to substantiate these opinions. Specific technology examples would be helpful.

3. There seemed to be a general theme among most panel members that if we are to be successful in coming to grips with our energy problems then we, as a nation, must make a long-term commitment. I would appreciate your thoughts on how we might get a long-term commitment by the general public to take the steps necessary to do the job. Are there measures that can be taken in the short run to initiate and retain public commitment?

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March 12, 1991

Mr. William Nitze, President
Alliance to Save Energy
1725 K Street, N.W., Suite 914
Washington, D.C. 20006

Dear Mr. Nitze:

Thank you for your excellent testimony at our February 28, 1991 hearing on the National Energy Strategy.

We would like to supplemment the record of the hearing with your responses to the attached questions. We would appreciate receiving your responses within three weeks from the date of this letter. Please forward this information to the Subcommittee on Energy office, B-374 Rayburn House Office Building, Washington, D.C. 20515, to the attention of Kathryn R. Holmes.

I appreciate your cooperation in this matter.

Sincerely,

George E. Brown, Jr.

GEORGE E. BROWN, JR.
Chairman

GEB:cf

Questions For The Record
Mr. William Nitze, President
Alliance to Save Energy

March 11, 1991

1. There seemed to be a general theme among most panel members that if we are to be successful in coming to grips with our energy problems then we, as a nation, must make a long-term commitment. I would appreciate your thoughts on how we might get a long-term commitment by the general public to take the steps necessary to do the job. Are there measures that can be taken in the short run to initiate and retain public commitment?

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JOHN H. GIBBONS
DIRECTOR

Congress of the United States
OFFICE OF TECHNOLOGY ASSESSMENT
WASHINGTON, DC 20510-8025

March 28, 1991

APR 1 1991

The Honorable George E. Brown, Jr.
Chairman
Committee on Science, Space and Technology
United States House of Representatives
Washington, DC 20515

Dear George:

I am pleased to submit OTA's response to the additional questions for the record of the February 28, 1991, hearing on National Energy Strategy. The hearing was interesting and productive and we appreciate the opportunity to assist you in your work.

Sincerely,

Jack

John H. Gibbons

Enclosure

Questions for the Record
Dr. John H. Gibbons, Director
Office of Technology Assessment

March 11, 1991 for the House Committee on Science, Space, and Technology hearing record for February 28, 1991

1. **In response to questions, you mentioned that there were significant differences in the estimates of CAFE impacts between your assessment and DOE's model. Would you specifically identify those differences and provide an explanation of why the two methodologies (DOE's and OTA's) produce different results.**

The DOE has estimated that the Bryan bill (S.279) would yield an oil savings of 500,000 barrels/day by 2005, and about 1,000,000 barrels/day by 2010. Much of the focus on the DOE estimates has been on the 2005 value, because Secretary Watkins has repeated this value several times. However, because of the time delay in moving new car improvements into the fleet through vehicle turnover, the 2010 value is a much better indicator of the long-term benefits of the Bryan bill.

The oil savings values I showed you at the hearings were based on OTA's estimate of the differences in oil use that would occur if the *actual* long-term average auto fuel economy changed from 28 mpg to either 38 or 50 mpg. DOE is calculating something subtly different, namely the savings associated with attainment of the Bryan bill's standards. DOE is calculating savings over the improved level of fuel use they believe would occur in the absence of any changes in standards, rather than the savings over the fixed 28 mpg baseline used by OTA. Further, because of the existence of CAFE credits, attainment of the Bryan bill's standards may occur without the fleet actually achieving the bill's 40 mpg goal.

The key to why DOE's estimate is lower than most others is the series of assumptions that drives the analysis and that define the baseline from which the potential savings would be measured, particularly in the areas of: future CAFE ratings *without* new fuel economy regulations; use of alternative fuels; increase in driving caused by better fuel economy; and likely growth of vehicle miles traveled (vmt) during the period 1990-2005. In OTA's view, the DOE has combined a series of assumptions that reduce the estimated positive impact of the Bryan fuel economy standards. DOE has assumed that the new car fleet will attain 38 mpg by 2010 in the absence of a standard, for example. This assumption, which we would characterize highly as optimistic, minimizes the impact of the Bryan standards because it minimizes the difference in the fleet fuel economies with and without the standard. DOE also assumes a large penetration of alternative fuels into the automobile market during this time frame, which decreases the number of vehicles that will be saving *gasoline* due to the Bryan bill, reducing the net oil savings. Large-scale production of alternative fuel vehicles would also allow the auto companies to meet the

Bryan numerical standards without actually attaining that high a fuel economy, by applying CAFE credits tied to this vehicle production. This would further reduce the net gasoline savings. In our view, such a large penetration will not happen spontaneously and, indeed, would require vigorous government action in support of alternative fuels development, including financial incentives. And DOE assumes a 20 percent "rebound" in greater driving because of increased fuel economy -- that is, 20 percent of the potential savings associated with the improved fuel economy is lost because drivers go more miles (because their fuel cost per mile has gone down). We believe that there *will* be a rebound effect, but a 10 percent rebound would appear to be closer to a consensus view.

Finally, DOE assumes a growth in vehicle miles traveled well below 2 percent for the period, even though the growth for the last few decades has been closer to 3 percent, and has been even higher during the past few years. Although OTA believes that VMT growth will slow from its current rate, we consider DOE's assumed rate to be on the low side of a "most likely" value. The lower value of VMT growth means that there would be fewer miles driven with which to apply the increased efficiency afforded by the Bryan bill, lowering the total savings.

2. In the discussion you noted that United States investment in technologies for alternative fuels and energy efficiency paid dividends in the early and mid 1980's. You also mentioned that in the 1980's we stopped making such investments and are now seeing the results. Is there specific evidence to substantiate these opinions. Specific technology examples would be helpful.

Much has changed since the 1970's and 80's. In particular, the energy consumption patterns of U.S. economy have evolved considerably, including many permanent structural changes driven by economics and technological change, such as increases in both the efficiency and flexibility of energy using technologies. Since 1973 the U.S. Gross National Product (GNP) has grown over 45 percent while consumption of energy has increased only 8 percent (see Figure 1 of my testimony). This amounts to about a 2.3 percent per year increase in energy productivity of the U.S. economy, (the GNP produced per unit of energy consumed). OTA has found that about one third of this decrease in energy intensity can be attributed to the changing structure of the economy (changing patterns of consumer demand, a shifting balance of imports and exports of both energy and non-energy goods, and the changing market basket of goods produced in the United States), but two-thirds of it is due to steady improvements in the efficiency of the use of energy in industry, commerce, and residences.[1] Since 1985, however, these historical increases in U.S. energy productivity have virtually stopped and U.S. energy use increased between 1985 to 1988 (see in Figure 1 of my testimony). This increase was due to a variety of factors, but one important driver was the decreased investment in energy efficiency in the U.S. occurring through the 1980's.

[1] For a detailed discussion of this trend see U.S. Congress, Office of Technology Assessment, Energy Use in the U.S. Economy, Background Paper, June 1990; or Kelly, H., P. Blair and J. Gibbons, "Energy Use and Productivity: Current Trends and Policy Implications," Annual Review of Energy, Vol. 14 (1989), pp. 321-352.

The United States invests in energy efficiency in two distinct ways - through direct investments (purchases) of energy efficient technologies, and through research and development (R&D). Direct investments (purchases) of energy efficient devices are driven by current energy prices and, perhaps more importantly, perceptions of future energy prices and availability. If people anticipate rising energy prices, energy efficiency figures more prominently in their purchasing decisions and they are more likely to buy an energy efficient device if one is available.

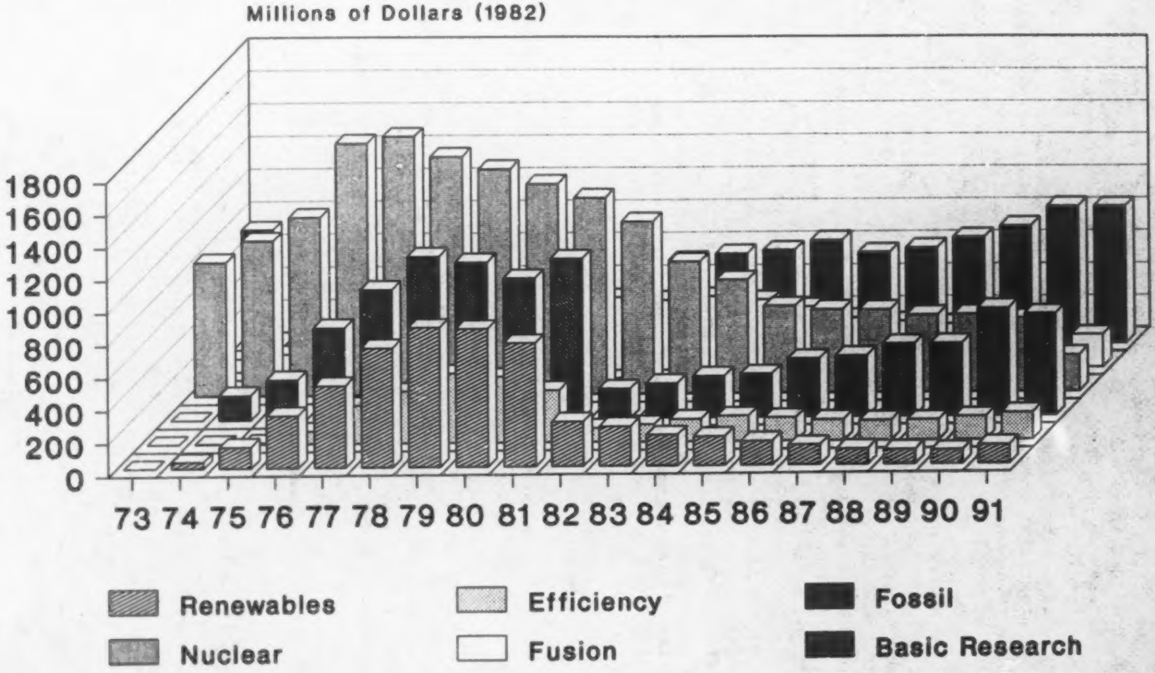
In an era of rising energy prices and uncertainty about future prices and availability, which was the case for most fuels from 1973 to 1982, people bought more efficient energy-using devices. In 1982, as energy prices started to drop and the sense of urgency about energy prices and availability diminished, emphasis on energy efficiency faded and people made less energy-efficient investments. By 1985 energy use started to rise. Nonetheless, The 1970s and early 80s "primed the pump" of technology innovation in energy efficiency. Despite low and generally stable energy prices for the last decade, the frontier of energy efficiency improvements continues to expand. Considerable future energy efficiency gains in all sectors of the economy are possible with existing technology, but more substantial gains are available with technologies in development as well. Since many of the easiest energy efficiency investments have been made, future ones may be more difficult to stimulate, perhaps requiring stronger policy incentives if price signals are insufficient.

R&D spending for efficiency at the Department of Energy (DOE) increased rapidly in the late 1970's, reaching a high of $430 million in FY79, and then dropped to less than $150 million/year from FY82 to FY90 (in constant 1982 dollars; see attached figure). The dividends of an R&D investment are difficult to measure, but there are many examples of technical successes which were made possible through DOE support. Rapidly changing technology generated many new easy options (e.g., high-efficiency lighting and improved insulation). For example, one such technology is the solid-state ballast. In 1976 DOE funded research at a national lab on an energy-efficient ballast for fluorescent lights. After several years of research and testing, this device became commercially available, and by 1984 over one million of these devices, which can cut lighting energy use by 25%, had been sold. The reduced R&D levels in recent years have led to fewer such success stories.

3. There seemed to be a general theme among most panel members that if we are to be successful in coming to grips with our energy problems then we, as a nation, must make a long-term commitment. I would appreciate your thoughts on how we might get a long-term commitment by the general public to take the steps necessary to do the job. Are there measures that can be taken in the short run to initiate and retain public commitment

Americans are notorious for taking a short-term viewpoint in many areas such as savings and investment as well as energy. While this short-term focus stems mostly from the current balance of incentives affecting investment decisions in our economy much more broadly than energy, let me note some of the particular parameters for energy.

Figure 10
DOE R&D Budget: 1973-1991
Selected Budget Lines



When energy is in short supply or threatens to be, our society can take drastic measures to conserve it. Gasoline rationing in World War II was accepted with a minimum of opposition. During the energy crisis of 73-74, many people took steps such as insulating their homes or buying fuel efficient cars. This trend continued after the crisis, in large part because prices remained high.

With plentiful supply and relatively low prices, as in the late 80's, interest in efficiency dropped considerably, and energy demand rose. Therefore, when you say long-term commitment to solving our energy problems, I think we can read that as getting the price up and keeping it up so people will make their decisions on its use on that basis. This may center around internalizing external costs of energy use that are not reflected in the market price for energy.

Oil and natural gas, our scarcest but most popular fuels, are not like most mineral resources. The exhaustion of low cost resources is in sight, especially in this country. It won't happen for several decades, but the world won't keep finding adequate supplies just by drilling more and deeper holes. There is a finite amount of resources. Thus the age of oil and gas will be over sometime in the next century, and world production probably will have peaked well before 2050, perhaps by 2010. In addition, the inertia of the energy system (both supply and demand) requires decades for major changes.

Furthermore, fossil fuels bear considerable external costs that are not included in their price. Oil spills, air pollution, CO_2 buildup, transportation accidents (pipeline breaks, coal train collisions, etc) and other problems are all costly. To this we must add the costs of threats to national security. The invasion of Kuwait would have been much less threatening to world security if Kuwait did not possess a substantial fraction of the world's petroleum resources.

These facts are not unknown to the American public. No one wants to pay more for energy or see their taxes raised. However, with strong leadership, they may accept it as necessary and essential for our collective interest. The war with Iraq may provide a unique opportunity to make the case. Even though ostensibly not over oil, everyone understood that oil was at least a major factor. Environmental improvements are also popular, and most people seem willing to pay to achieve them. Improving deteriorating roads and bridges was worth 5 cents/gal to most people a couple of years ago. Why should we give up on convincing ourselves that these other factors, which are potentially much more critical, require payment also?

Questions for the Record
Dr. Peter D. Blair, Program Manger, Energy and Materials
Ms. Joy Dunkerley, Senior Analyst, Energy and Materials Program
Office of Technology Assessment

March 7, 1991 for the House Committee Banking, Subcommittee on International Development, Trade, Finance, and Monetary Policy for hearing record for February 26, 1991

1. Degree of Organization to Address Developing Country Energy Problems. To pursue a matter that surfaced briefly at the hearing, would you care to comment further on how the various institutions you have been in contact with in the course of your study--such as the international financial institutions, the executive branch and the congress--are organized to deal with the energy problems of developing nations in a global context?

The final chapters of our report "Fueling Development: Energy and Technology in the Developing Countries," currently under preparation, will discuss how international financial institutions, executive branch agencies and Congress are organized to deal with energy problems of developing countries. While we have not yet completed our interviews and analysis, it is clear that there are already in existence a large number of U.S. agencies, programs and policies dealing with various aspects of energy in the developing countries - energy sector loans, grants, education, training, technical assistance, research and development, information services, policy advice, support to exports and private investment. Efforts are being made to coordinate some of these activities, for example through the congressionally mandated Committee on Renewable Energy Commerce and Trade (CORECT). While many programs were originally developed to support large-scale conventional energy projects, the system is evolving and several programs are making efforts to respond to new needs - the special needs of energy conservation and renewable small scale energy projects and the often small companies that develop them; and the encouragement of a larger private sector role. Our investigations are not sufficiently developed at this point to arrive at conclusions about the overall balance of these programs, but the subject will be addressed in the final assessment report.

2. Capital Needs for Energy Needs of Developing Countries. Your report cites a figure of $125 billion per year in investment capital needed for the electric power needs of developing nations. To what extent are the OTA and the international financial institutions aware of the total needs for investment capital in the energy sector in these countries, including such activities as agriculture, construction, heavy industry, transportation,- and urban development? what are the prospects of the subcommittee receiving such an overall assessment?

Developing countries already devote a large share of their total investment, both public and private, to the energy sector. Thus, many countries invest 30 percent and more of their public investment in energy facilities, and a substantial share of private investment also goes to energy. Even so, current levels of investment are believed to be too low. AID for example, estimates that electricity investments (which represent just under one half of all energy investments) would have to double, from the current level of $65 billion to $125 billion to provide adequate electricity service. At this level, annual investment in the electricity sector would take up a large part of the annual increase in the Gross National Product of developing countries leaving little for other energy projects, or other pressing development needs such as agriculture, construction, industry, transportation. OTA has drawn attention in its interim report "Energy in Developing Countries" to the broader economic and development implications of energy investments, and will develop this theme further in its final report.

3. U.S. and U.S.S.R. as Top Oil Consuming and Producing Countries. It is interesting that the U.S. is the leading consumer of energy (24 percent of world total energy 26.5 percent of world total oil production) and the U.S.S.R. is second. Also, at least until the invasion of Kuwait, these countries are also number 1 (U.S.S.R.) and number 2 (U.S.) in terms of oil production. So, our two countries are, at the moment, still energy superpowers, but we are not accustomed to thinking in those terms. Has the Office of Technology Assessment done any research and/or analysis about this relationship--for example, the relative levels of technology in the Russian oil industry as compared with the American oil industry? Do we know what the U.S. might have to offer the various elements of the oil and energy industries of the U.S.S.R. in the technical areas? What work has been done on that?

OTA has not engaged in studies of the relative levels of technology in the Soviet and U.S. oil sectors. However, GAO is at present conducting such a study, including the potential for oil technology transfer from the US to the Soviet Union. The responsible GAO staff person is Elliot Smith, Assistant Director, National Security and International Affairs, telephone 202 275 1554. In 1981 OTA did complete the assessment report, "Technology and Soviet Energy Availability," OTA-ISC-153, November 1981, which was directed at this question. While it is some hate, especially with respect to technology and the political context, it should still be relevant and useful.

4. Relevance of the Energy Department Organization Act of 1977. Your statement discusses the need for a national energy strategy (on page 2) and refers to U.S. energy policy (on page 15). As we read the Energy Department Organization Act of 1977 (42 U.S. code 7321), the President is called upon to submit to congress a national energy policy plan, which contains 5- and 10-year goals for U.S. energy policy and identifies the strategies, resources, and statutory and regulatory changes needed to reach the overall objectives. In the work the OTA has done in the energy field since the mid-19705, has it examined these provisions? Do you have any comments about the relevance of this statute to the current situation?

OTA has not specifically examined these provisions. In 1977 we analyzed the National Energy Plan prepared and proposed by the White House prior to the organization of the Department of Energy. Subsequently, we have used the plans submitted by DOE in our work, but in recent years they have been much less comprehensive and useful than in the seventies. The National Energy Strategy is a major advancement over those efforts. However, if the President is adamant about relying primarily on the marketplace in precisely those areas where policy could produce the greatest benefits, then the value of these provisions is questionable.

5. Relevance of Energy Policy Efforts of 1970s. In your earlier report on "Energy Use and the U.S. Economy," to which your testimony refers, you point out that, between 1972 and 1985, 20 million homes, 50 million vehicles, and 1.5 million businesses were added to the nations inventory as gross domestic product increased 39 percent. Yet, energy use during that period increased a total of only 1.9 percent, or less than one-half percent per year (0.3 percent). If you would focus on the policy aspects, like the federal fuel economy, appliance, and building energy standards, have there been studies of the role these and other federal policies played in that remarkable energy performance? Has OTA done any such studies? If not, would such studies be appropriate?

OTA has examined all areas of energy demand and the effects of policies. The results are decidedly mixed. In the industrial sector, the OTA report "Industrial Energy Use" (June 1983) concluded that policy had a negligible effect, because the initiatives (tax credits, etc.) were too small to make a difference relative to other forces driving decisions by companies. The cost of energy and expectations of further increases were far more important, but even attractive investment opportunities could be ignored if they didn't fit into overall corporate strategy.

In the residential and commercial sector, the OTA reports, "Residential Energy Conservation" (1979) and "Energy Efficiency of Buildings in Cities" (1982), also found that saving money was the prime motivation for improvements in this sector, but that policy could have a significant effect. Information, training and state assistance programs as well as tax credits were found to be worth consideration, though no effort was made to specifically quantify the impact of past programs.

In the transportation sector, the OTA report "U.S. Vulnerability to an Oil Import Curtailment" (1984) noted some of the ways that efficiency had improved, but did not distinguish between the CAFE standard and customer demand as the motivation. "Replacing Gasoline" (1990) also did not independently evaluate policy. We have tracked the arguments as to which was more important, and it is apparent that both had an effect. OTA is now updating its work on energy demand and efficiency in all sectors of the economy in the on-going assessment, "U.S. Energy Efficiency: Past Trends and Future Opportunities." In that work we are focussing on where policy can make a difference in a series of five reports on energy use in the Federal government itself, in industry, in the residential and commercial sector, in transportation, and in electric and gas utilities.

6. Projections to the Year 2000 by the Federal Government in the 1970s. To follow up on the previous question, the energy research and development administration (E.R.D.A.) in 1975, under President Ford, projected that energy use would grow 60 percent by the year 2000. According the work O.T.A. has done, what is your opinion on

the percentage growth in energy consumption from 1975 to 2000? If your prediction is different than that of E.R.D.A., why is it different?

OTA has not produced energy projections that correspond directly to those of ERDA in 1975. Certainly ERDA greatly underestimated the potential for efficiency gains, but in 1975 almost everyone else did also. This was in part because energy prices rose faster in the seventies than expected, and people were very creative in finding ways to use less. As you note in question 5, energy demand grew almost negligibly from 1972-1985. Therefore a 60% rise by 2000 is way too high. That would be about 120 quads. One OTA study "The Direct Use of Coal" (1979) considered three scenarios for 2000 involving 150, 125 and 100 quads. The first was essentially dismissed as improbable, even though it was lower than some projections, such as by the Electric Power Research Institute at the time. Even the mid-range projection was seen as somewhat inconsistent with the price levels for fuels assumed. The actual demand that we will encounter in the nineties is of course unknown, but recent experience suggests that if the economy continues to grow and energy prices stay somewhere near present levels, then 100 quads will be about right in 2000. This about half the growth rate predicted by ERDA, and virtually would occur in the second half of the period.

7. E.R.D.A.'s Predictions for the Year 2000. Do you think that E.R.D.A.'s projections for the year 2000 were helpful? Do they shed any light on the energy policy goals the nation should chose now for the year 2000, which would correspond, at this point, to the objectives for 10 years into the future, as called for by the energy department organization act?

Without examining ERDA's projections we cannot say how valuable they have been. The purpose of such projections is to assist in developing policy at the time they are made. Thus they are now of historical interest only, perhaps in determining how much we have learned in handling energy uncertainties. Policy at this point should be analyzed in the context of the actual past energy trajectory, improved understanding of the relationship between the economy and energy and better estimates of future energy use and supply.

8. Market Prices at Which Energy Efficiency Would Be Attractive. On page 7 of your statement, you state that future improvements in energy efficiency in this country may be "more difficult to secure without higher energy prices." Pursuant to our discussion in open session, can your computer model tell us what crude oil prices would yield a 25 percent improvement in energy efficiency over the next 10 years? If you would be willing to make that projection on the O.T.A. model, and/or work with the Department of Energy model, to provide an answer for the subcommittee's hearing record, we could greatly appreciate it.

and

9. Market Prices At Which Oil Use Is Reversible. On the same page of your testimony, you state that "a considerable portion of (increases) in oil consumption both in the U.S. and the remainder of the free world is reversible." Similarly, could you work with the O.T.A. and Department of Energy computer models and tell us at what

price U.S. use of oil in transportation, utilities and industry would decline to the extent that a 35 percent level of imports would result by the year 2000?

OTA's internal analytical tools are not well equipped to answer these questions. Both questions have recently been addressed by many modeling exercises in DOE, EPA, the Gas Research Institute, the Stanford Energy Modeling Forum and others. We will be considering these modeling results in the course of our on-going assessment on U.S. energy efficiency, and will be pleased to report on them for the Subcommittee's hearing record as our analysis is completed. It is important, however, in drawing conclusions from any of the relevant model results in this area, to consider the assumptions under which such projections are made, including economic growth, alternate fuel prices, and many others. We are sorting out the various assumptions made, for example, in the National Energy Strategy modeling activities and the implications they have regarding the conclusions reached in the NES policy proposals.

10. Proportion of Energy Capital Investment For Which Capital Exists. On page 11 of your statement, you discuss the size of the capital needs for energy projects in developing countries. Do you have any preliminary opinions at this point as to what proportion of those needs do you believe will be met by public or private sources and what proportion do you believe will go unmet under current policies?

Estimates[1] of energy sector financing in developing countries in the early 1980's suggest that half of the investments were in the form of local currency resources, and half in foreign exchange. Local currency resources came largely from public sector funding - either from revenues of the largely state owned electricity and oil and gas supply facilities, or if these revenues proved insufficient, from general budget allocations.

The foreign exchange component of energy investments came from a variety of sources. About one half of the total was borrowing from abroad, equally divided between export credits, financial institutions, and multilateral and bilateral aid combined. The other half of the foreign exchange component was from foreign investment (largely oil companies) and the expenditure of developing countries own foreign exchange resources. These data suggest that in the early 1980's, about two thirds of energy sector investment came from the public sector (multilateral and bilateral aid and local currency resources), and one third from the private sector (direct foreign investment, loans from banks and export related loans). By the end of the 1980's, however, the share of the public sector in the total had risen as private lending fell sharply. The respective shares of the public and private sector in energy sector investment in the future will depend on the extent to which bank and export related loans will revive, and the extent and success of privatization in the developing countries.

An informed estimate [2] of future investments in the electricity sector (about one half of all energy sector investment) suggests the existence of a large financing gap. According to this estimates, capital expenditures on electricity in the first half of the 1990's would be $380 billion, of which $150 billion would need to be in foreign exchange to pay for imported equipment and related services. Official and private creditors are thought to be unlikely to increase their contributions from the present level (the equivalent of $35 billion over the five year period), thus leaving a shortfall in foreign exchange financing for this period of about $115 billion. Note that this shortfall does not take into account debt service commitment on existing foreign loans for power development ($60 billion) and the foreign exchange needed for imported fuels, and plant maintenance. According to the same source, the financing of local currency needs also appears highly problematic.

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[1] The Energy Transition in the Developing Countries World Bank Washington DC

[2] Gunter Schramm "Electric Power in Developing Coutnries: Status, Problems, Prospects" Annual Review of Energy 1990 15:307-33.

11. Importance of International Energy Policy Efforts to the Global Environment. On page 12, you indicate the impact of developing country energy policies on the environment by stating that the proportion of carbon dioxide (CO_2) emissions from fossil fuels in these countries is predicted to reach 44 percent of the world total in 2025. If you add to that the CO_2 from tropical deforestation and other sources, what would be your estimate of the overall percentage of CO_2 generated by developing countries in 2025? If such an estimate is not readily available, how could it be pursued and provided for our hearing record? From these indications, it appears that, within a generation, developing countries might be contributing a majority of the world's greenhouse gas emissions if current energy policies are not changed. Doesn't this trend make an urgent case for a fresh look at international energy and economic policies?

The developing countries are a major contributor to global greenhouse gas emissions. According to estimates prepared for the IPCC Working Group III[3], developing countries contributed in 1985 about one quarter of annual global energy sector CO_2 emissions. With expanding populations and rapidly increasing energy use, developing countries are projected to produce roughly 45 percent of global energy sector CO_2 emissions in 2025 and near 60 percent in 2100.

While the CO_2 emissions from the energy sector are fairly well known, there are large uncertainties about the contribution of emissions from tropical deforestation which makes it difficult to calculate with confidence the total developing country share of annual CO_2 emissions. It is known, however, to be substantial; by various estimates, tropical deforestation could be the source of between roughly 7 to 35 percent of total annual CO_2 emissions. Developing countries are also significant and growing sources of energy sector CO and NOX emissions. Developments in third world countries are therefore of high and growing relevance to US concerns over global climate change.

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[3] The IPCC is the Intergovernmental Panel on Climate Chamnge, an international task force created by the World Meteorological Organization and the United Nations Environment Program. Initiated in 1987 this body focuses on analyzing current information on climate change issues and devising strategies to address climate change.

12. Role of Biomass in Developing Nations. Your report indicates that biomass (wood, crop & human residues) is the dominant fuel in developing counties. Does the U.S. have technology that would make a substantial difference to these countries in the conversion of municipal waste, use of wood, and/or other areas? Are the international financial institutions addressing the biomass issues adequately, and are they equipped to do so? Is the U.S. addressing these issues adequately?

Biomass is a very important fuel for developing countries, currently providing roughly one-third of total energy requirements and a much larger share of energy needs in rural areas. The primary use of these biomass fuels is cooking, done on low-efficiency traditional stoves. More efficient use of this fuel is possible with improved stoves which are now being made and disseminated in a number of developing countries. The highly dispersed nature, low capitalization, and necessarily simple form of these stoves and related technologies suggest that this market is inappropriate for U.S. firms to enter in any manner, except perhaps for altruistic concerns. Further, attempting to back out fuels from individual households through the use of improved stoves, and to then collect this fuel at central, large-scale facilities for power generation would pose difficult logistical problems.

On the other hand, large amounts of biomass are available in developing country agroindustries -- including sugarcane residues, rice husks, bark and sawdust from lumber mills, and many others -- but are currently used inefficiently, if at all. The United States has a number of technologies available commercially or near commercialization that would make more efficient use of these biomass residues, potentially providing a significant export market for U.S. technologies. Currently, most agroindustries in developing countries use low pressure steam turbines to produce electric power for on-site equipment. The U.S. (and many other countries) have high-pressure steam turbines that can generate far more electricity while burning the same amount of residue. These are now used widely in the forest products industries, and the cane sugar industry -- particularly in Hawaii, and elsewhere. Further improvements in biomass fired electricity generating technologies are now or could soon be available. Most significant of these is the use of gas turbines in either steam injection or combined cycle modes. These systems appear to offer relatively low capital costs, high efficiencies, availability in medium-small scales, and modularity. The U.S. is a world leader in gas turbine technology, due in part to significant and continuing investment by the Department of Defense. These technologies would appear to be a good opportunity for the U.S. to develop a significant export market; at the same time, these technologies could lower the cost of generating electric power in developing countries.

We are at present investigating U.S. and international agency policies with regard to the transfer of biomass conversion technologies to the developing countries. These issues will be developed in our final report.

13. Potential for Exports Generated by World Energy Needs. On page 14, you indicate that developing countries "offer huge potential markets" for American businesses in the energy field. Where are the

centers of expertise on the extent of these markets? What sources does O.T.A. use to inform itself of the federal government efforts to help American private identify, assess and develop those markets?

As above, some $65 billion is spent each year by developing countries on electric power, of which about one half is imported equipment and related construction, engineering and project management services. A study of the worldwide overseas (i.e., outside the United States) power generation market[4] projects that 1128 GW of new power generation capacity will be ordered between 1991 and 2010, and that about 55 percent of this total will originate developing countries. The total associated investments in this overseas power market are estimated at $2140 billion of which 43 percent or just under $1 trillion would need to be imported. The same report estimated that the US might account for one tenth of this market or about $90 billion, of which one half could be in the developing world. Companion reports suggest a market for US exports of oil and gas exploration and production equipment and services, of an additional $110 billion, of which a substantial share would occur in developing countries. Finally, expanding markets in energy conservation equipment could result in US exports of $50 billion.

OTA uses a variety of sources to inform itself the federal government efforts to help American private enterprises identify, assess and develop those markets, including reports issued by the various agencies and qualified observers, interviews with agency officials and their clients such as private corporations interested in participating in developing country energy projects.

14. O.T.A.'s Follow Up Report. The Subcommittee was pleased to offer this hearing as the first congressional presentation of your excellent report on "Energy in Developing Countries." The subcommittee looks forward to the second report this summer that will be recommending solutions to the energy problems of these developing countries. We will undoubtedly want to talk with O.T.A. about presentation of the conclusions of the second report to the subcommittee at the appropriate time.

We very much appreciate the Subcommittees interest in our first report, and look forward to presenting the conclusions of our final report "Fuelling Development: Energy and Technology in the Developing Countries" at the appropriate time.

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[4] "Opportunities in the Worldwide Overseas Power Generation Market" prepared for US Agency for International Development, Office of Energy by RCG/Hagler Bailly Inc

COMMONWEALTH OF PENNSYLVANIA
LIEUTENANT GOVERNOR'S OFFICE
HARRISBURG 17120-0002
717-787-3300

MARK S. SINGEL
LIEUTENANT GOVERNOR

April 11, 1991

Kathryn R. Holmes
Subcommittee on Energy
Committee on Science, Space and Technology
U.S. House of Representatives
B-374 Rayburn House Office Building
Washington, D.C. 20515

Dear Ms. Holmes:

As a follow-up to my testimony on February 28, 1991 regarding the National Energy Strategy, I am sending you my responses to the three questions for the record posed by Chairman Brown in his letter to me of March 12.

I appreciated the opportunity to share my views with the committee. Please contact me again if I can be of any further assistance.

Sincerely,

Mark S. Singel

cc: The Honorable George E. Brown, Jr. (with attachment)

Questions and Answers for the Record
Honorable Mark S. Singel, Lieutenant Governor
Commonwealth of Pennsylvania

April 11, 1991

1. *You mentioned that the State of Pennsylvania has a number of research and development projects underway in the energy area. In particular you noted the efforts in the use of hydrogen for fuel cells and for direct use. We would be interested in learning about these programs including information on the level of R&D investment, cost-sharing with industry and progress to date.*

The Pennsylvania Energy Office operates four major energy R&D programs. The first is the Energy and Environment Program, which funds energy projects which have environmental impacts which are more benign or beneficial than the traditional energy practices. The hydrogen fuel cell automobile work is one of these projects. The automobile will be propelled by electric motors, using electricity generated by a proton exchange membrane fuel cell which uses hydrogen gas from a metal hydride storage system. This is one of our most exciting projects, but there are many more listed on the attached document entitled "Pennsylvania Energy Office Initiatives in Sustainable Energy Systems Design." If you have any questions about any of these projects, please contact Phillip Schuller at the Pennsylvania Energy Office (717-783-9981).

The second major program is the Recycling Technology Demonstration Program, which encourages the development of new technologies to process and use recycled materials. This program is designed to help Pennsylvania implement its mandatory curb-side recycling program. These projects are also listed in "Pennsylvania Energy Office Initiatives in Sustainable Energy Systems Design."

The third major energy R&D program is run by the Pennsylvania Energy Development Authority (a subset of the Pennsylvania Energy Office). This program focuses on the production and use of coal and Pennsylvania's other indigenous fuels. A list of PEDA projects is also attached. If you have any questions about any of these projects, please contact Dane Bickley at the Pennsylvania Energy Office (717-783-9981).

The fourth program is our alternative transportation fuels program. A list of these projects is also attached and if you have any questions about any of these projects, please contact Susan Summers at the Pennsylvania Energy Office (717-783-9981).

I should note that except for the Pennsylvania Energy Development Authority program, these R&D efforts are funded with petroleum overcharge funds. Unfortunately, we expect these funds will be depleted in Pennsylvania in another 18 months or so.

2. *Also, we would be interested in your opinions as to how federal and state government R&D programs could be enhanced in terms of coordination, demonstration or in other aspects.*

I have been very pleased by the quality of the R&D programs of the Pennsylvania Energy Office. We have been very successful in building partnerships which leverage private and other public funds.

I think there are three keys to this. The first is attitude. Partnerships are nice to talk about but they take effort to build and to manage. We need to overcome concerns about turf and ego and be willing to undertake the tough task of coordination and compromise.

The second key is a clear sense of purpose and direction. We need a research agenda which clearly articulates its goals and provides a blueprint for future steps (I discuss this more in my answer to question 3). Single project efforts which burn brightly for a moment and then fade away do not work. We need a sustained effort and a long term sense of direction to nurture partnerships.

Third, we need to redouble our efforts in information exchange. Making the massive amount of information about research projects and results accessible is a tough challenge but one we must master. Anyone in the field interested in a particular issue should be able to make easy contact with the right people.

Notice that I did not list an increased budget as one of the keys. I strongly believe that we must redirect much of the federal research budget and increase certain components of it, but increased spending alone will not improve coordination.

3. *There seemed to be a general theme among most panel members that if we are to be successful in coming to grips with our energy problems then we, as a nation, must make a long-term commitment. I would appreciate your thoughts on how we might get a long-term commitment by the general public to take the steps necessary to do the job. Are there measures that can be taken in the short run to initiate and retain public commitment?*

First, we in government must articulate our long-term vision of our energy future. Where is it we should be headed? What are the fundamental principles that our energy future must reflect if it is to be sustainable? The public's solid support for energy efficiency, energy security, renewable energy and a clean and stable environment indicate to me that the public is well along in identifying the foundation principles for our energy future. Another fundamental principle that I would like to suggest is that we work to get the prices right. Almost all of us have come to recognize that the market makes better energy decisions than government officials, but a market which is permitted to externalize major costs (such as environmental impacts, national security concerns and social impacts) cannot make optimum decisions. We need to identify these external costs and improve the functioning of the market.

Second, we must then plan the transition from where we are today to where we need to be tomorrow. Some of our current technologies and practices are already sustainable and will continue into the future. Other technologies and practices may be less appropriate and must be modified or abandoned over time. New technologies and practices need to be developed, some of which will continue on a long-term basis and some will have only a short transition role to something better. A similar sort of transition should be mapped for accomplishing the fundamental policy goals. We in government need to facilitate the open process of drafting this transition blueprint.

By developing this long term vision and this blueprint for the transition, we develop the context in which our specific energy conflicts can be resolved.

Attachments:
(1) Pennsylvania Energy Office Initiatives in Sustainable Energy Systems Design
(2) Pennsylvania Energy Office Alternative Transportation Fuel Program
(3) Pennsylvania Energy Development Authority Project Listing

Pennsylvania Energy Office

Initiatives in Sustainable Energy Systems Design

For the last four years, the Pennsylvania Energy Office (PEO) has been steadily developing and funding a set of projects which demonstrate sustainable energy systems. The common themes of these projects are technological excellence, economic viability and extensive partnerships between the PEO and other private and public interests. These projects have included:

Energy use in buildings

(a) Harmony House

Technologies supporting sustainability have been retrofitted onto an existing building including photovoltaics, passive solar greenhouse and solar domestic hot water. The building was built with environmentally benign materials and treats all its wastes, recycling its greywater to the greenhouse and utilizing a clivuus multrum.

(b) Reading VoTech House

This will be a demonstration of state of the art energy conservation technologies and building techniques. It will be constructed by vo-tech students and have the financial support of numerous companies which manufacture construction materials.

(c) Solar desiccant air conditioning

The PEO is supporting two projects which demonstrate the use of the sun during the summer when solar energy is most available. The desiccant system dehumidifies air so that it does not need to be cooled as far to achieve the desired comfort level. Solar energy is used to drive the moisture from a desiccant which collects humidity from make-up air. At the Monroe County Courthouse, the PEO is conducting an electronic-based evaluation of an existing system with approximately 3,000 square feet of collector. The PEO is also funding a demonstration of an advanced solar-desiccant system at the University of Pennsylvania.

(d) Solar advanced evacuated tube

Swarthmore College is demonstrating and testing evacuated tube collectors and has established a facility to test a variety of collectors.

(e) Passive Solar Modular Home

Bradley Builders is constructing a passive solar, factory built house in Chester County. The home will incorporate ample south-facing glazing and thermal mass with an electric in-floor, hydronic heat distribution system for back-up heating.

(f) Advanced Building Technologies Center

Carnegie-Mellon University is designing and building a demonstration facility which will incorporate a variety of building and design features. Indoor air quality, energy self-sufficiency and advanced enclosure systems are some of the guiding concepts. The building is expected to incorporate, photovoltaics, passive solar design, light sensing and dimming hardware, advanced mechanical systems and co-generation.

(g) Relamping with compact fluorescent lamps

The PEO has supported a number of projects through which high efficiency lamps have replaced incandescent bulbs. Demonstrations of this technology in public facilities are underway at Pennsylvania's main capitol building, the State North Office Building, the Philadelphia City Hall and the Philadelphia Museum of Art. The goal of all of these projects is to have compact high efficiency fluorescent lamps added to the purchasing specifications of the Department of General Services or other purchasing authority.

Additional demonstrations of this technology in the commercial sector have begun at Kauffmans and Horne and Co., two department stores in downtown Pittsburgh. Funding for these projects is from a rate settlement case with Duquesne Light.

(h) Commercial-scale wood energy systems

The PEO facilitated and financially supported the conversion of the central plant heating and cooling system of the Warren State Hospital to a waste-wood energy system.

(i) Non profit organization program

The PEO is working with community foundations throughout Pennsylvania to provide grants to local nonprofit organizations to fund energy efficiency improvements. The arrangement with the foundations allows the PEO to leverage significant private funding.

The PEO has also provided technical support to the efforts of a nonprofit organization in York to reduce its energy costs through peak load reduction (reducing demand charges significantly) and overall energy use reduction.

Additionally, the PEO's Institutional Conservation Program has provided over $60 million to Pennsylvania institutions to help reduce energy consumption and costs. Types of projects funded included energy management systems, lighting modifications, insulation, boiler retrofits and more.

(j) Critical Needs Weatherization project

This demonstration program reduced the space heating energy usage in 25 row houses in Pittsburgh and Philadelphia by 50% through "House Doctor" air infiltration measures and by installation of high efficiency through-the-wall natural gas space heaters.

(k) CARES project

The Community Action and Resources for Energy Savings (CARES) program has selected the Borough of Honesdale, the county seat of Wayne County, as the focus of a comprehensive program to demonstrate the art of the possible by implementing a wide array of energy efficiency efforts in a concentrated area. Programs are being implemented to address energy opportunities in the County

Courthouse and other local government buildings, the business district, the public housing development, the senior citizen community, the mobile home park and the schools.

(l) Solar-Electric Storage

Solarex of Newtown Pa., in cooperation with Philadelphia Electric Company, is demonstrating two aspects of the use of photovolatic systems. Two systems will be demonstrated and monitored with respect to their interaction with the grid. One system will be a 2kw system on a residence and the other will be a 5kw system on an institutional or commercial facility.

At PECo's airport PV site batteries will be installed in addition to PV cells in order to demonstrate and evaluate the storage of solar electricity for use later in the day (4-5 PM) during the utility's peak demand period. It is hoped that these systems will prove useful in supplying a portion of the utility's demand and reduce the need for new centralized plant construction.

Energy and resource use in agriculture

(a) The bio-shelter

Three Sisters Farm and Nursery has constructed a 3,600 square foot bio-shelter advancing the state of the art beyond New Alchemy and other efforts to date. This barn-greenhouse combination structure sequesters carbon dioxide from the animals directly in plant growth within the building. It is producing high value salad greens on a year-round basis, thus improving local food quality while reducing transportation emissions related to food supply.

(b) Low input farming

The PEO and the Pennsylvania Energy Development Authority has supported the Rodale Research Center in the development of low input agricultural practices. These practices reduce energy demands by reducing tillage and commercial fertilizer use.

(c) Aquaculture

Freshwater Culture Systems designs and builds fish culture systems and with the support of the PEO is developing a waste treatment system for fish wastes. The methane produced from the digestion of these waste is used to heat incoming water to maximize fish production. The demonstration facility is located in an in-land, urban setting, thus reducing food related transportation costs and improving the purity of the fish fillets.

(d) Nutrient studies of composted MSW and manure

The Rodale Research Center is comparing total energy demands of the use of commercial fertilizers to the use of compost as a means of providing nutrients to crops. The compost is made from waste paper and animal manure, thus providing a beneficial use for non-recyclable paper and stabilizing manures to reduce agricultural run-off.

(e) Animal bedding from old newspaper

The PEO has supported the use of old newspaper as animal bedding. Once this material is removed from the stalls and applied to agricultural land, it can become part of the carbon cycle when it is picked up by plants.

(f) Low Temperature Grain Drying

Under this project Penn State University demonstrated that grain could be effectively dried without the use of high-temperature, gas-fired dryers. Grain bins were equipped with blowers which moved ambient air through the bin nearly 24 hours a day. The system required much less energy to operate including the costs of running the blowers.

Energy in resource recycling and waste treatment

(a) Vertrol process for treating sewage sludge

In this project, the by-product of an innovative sludge processing technology is being used in the manufacture of bricks. The sludge processing is being developed by Air Products and involves the injection of oxygen into a deep shaft filled with sludge, thus neutralizing an volume-reducing the material.

(b) Lebanon municipal co-composter

The PEO, working with the Pennsylvania Department of Environmental Resources' Bureau of Soil and Water Conservation, is funding a composting facility which will convert part of the MSW stream and manure into a stable soil amendment product. It is planned that waste paper such as water damaged newspaper, rice based cardboard and other papers will be composted with hog manure.

(c) Philadelphia newspaper recycling to cellulose insulation

This project will develop the capacity for insulation to be produced from old newspaper recovered in the City of Philadelphia's recycling program. The cellulose insulation will be used in the City's housing and weatherization programs. The demonstration will show the benefits of a closed, local system for handling wastes and achieving energy conservation.

(d) Plastic recycling

St. Jude Polymer is assembling a recycled plastics handling and washing line which will demonstrate improvements over existing methods. As part of the project, the company's principal customer is providing baling equipment to local communities to facilitate plastic recycling.

(e) Strip mine reclamation with composted waste and manure

The Lackawanna Solid Waste Authority will incorporate a composting facility into their recycling center. The resulting compost will be used for the reclamation of abandoned strip mine area in the region. The compost will be produced from water damaged newspaper, leaves and yard waste. Several relevant agencies are involved in the project, including the U.S. Soil Conservation Service, the Pocono Resource Conservation and Development Council and the DER Bureau of Abandoned Mines Reclamation.

(f) Foundry Sand Reclamation

A medium sized foundry is installing an electric powered foundry sand reclamation unit at its plant. This technology will save considerable transportation and mining energy usually needed for new foundry sand. Additionally, the process reduces the demands which are normally put on landfill space from the standard practice of disposing used foundry sand.

(g) Recycling commodity market conference

On May 9, 1990, the PEO played a central role in the planning and conduct of a one day event during which nearly 400 buyers and sellers of recycled materials met to discuss materials transactions on a one-to-one basis.

(h) Waste water treatment

The PEO has operated a number of audit, workshop and demonstration programs to improve energy efficiency of waste water treatment facilities.

Energy Use in Transportation

(a) Hydrogen fuel cell powered automobile

The PEO has contracted to provide the world's first hydrogen fuel cell powered automobile. This vehicle, which will be delivered in the summer of 1991, will be the transportation component of this project.

(b) PV powered commuter car

The PEO is funding Villanova University to develop a solar powered commuter car which will pass all Pennsylvania State inspection requirements. The car will seat two passengers and be powered by 500 watts of photovoltaic cells which convert sunlight directly into electricity.

The car will have a gross weight of 1600 lbs and a top speed 70 mph. The car body is a Sebring-style fiberglass body and propulsion is provided by a 25 HP Unique Mobility motor.

(c) Compressed Natural Gas Retrofits

The PEO is funding a large number of vehicle retrofits to allow the use of compressed natural gas as a transportation fuel. State government, through the Pennsylvania Department of Transportation, is participating. The York Area Transit Authority is also having a number of its vehicles converted, as are several private firms with vehicle fleets.

Educational Efforts

(a) Masters of Science in Sustainable Systems curriculum

As a result of the bio-shelter success and the construction of the Permaculture Center at Slippery Rock University, the school has asked the PEO to help it design the curriculum for a new degree in Masters of Science degree in Sustainable Systems. This program will give students a whole systems grounding in sustainable design for the built environment. There will be course tracks in both agriculture and energy, with emphasis on sustainable community design.

(b) Pennsylvania Energy Center program

The PEO operates seven centers through Pennsylvania to provide energy outreach services to Pennsylvania citizens, small businesses, farmers and others. These services include energy efficiency site visits, workshops, and printed information.

(c) New Science curriculum development for K-6

The PEO is funding the development of a new science curriculum for kindergarten through grade six. The themes of energy and environment are used to teach fundamental science concepts with special emphasis on regenerative systems in the built environment.

Energy Policy Efforts

(a) An Energy Policy for Pennsylvania

An Energy Policy for Pennsylvania is the state energy policy issued by the PEO in December 1988. One of the key themes in the document is the link between energy policy and environmental consequences. This document introduced the concept of stewardship of our state's energy resources.

(b) National Governors' Association

As a member of the Energy and Environment Committee of the National Governors' Association, the PEO played a leadership role in shaping the National Energy Policy Statement to recognize environmental impacts.

(c) NASEO Committee on Global Climate Change

In recognition of its work in the NGA Energy and Environment Committee, the PEO was asked to create and chair a committee on global climate change for the National Association of State Energy Officials.

(d) NGA Task Force on Global Climate Change

Though not a formal member of the National Governor's Association's Task Force on Global Climate Change, the PEO has participated in many of the Task Force's meeting and contributed to the report that is due to be released in June.

(e) Soviet Union Reciprocal Visits

The PEO was invited to accompany a team of five U.S. experts in renewable energy technology and sustainable energy systems to a two week visit to the Soviet Union in October, 1989. This visit was arranged by a Soviet group named Ecology of Peace. In April, 1990, the PEO hosted a reciprocal visit by thirteen Soviet officials interested in U.S. efforts in low input agriculture, renewable energy and sustainable energy technologies.

For more information about these programs, contact Phillip Schaller at the Pennsylvania Energy Office, 717/783-9981.

Pennsylvania Energy Office
Alternative Transportation Fuel Program

The Alternative Transportation Fuel Program was established in 1988 by the Pennsylvania Energy Office to address the problems of increasing urban air pollution and increasing dependency on foreign oil. Since motor fuels are the principal cause of urban air pollution and account for most of the pollutants that contribute to the formation of ozone, the ATF Program was designed to promote the use of cleaner burning alternative fuels such as compressed natural gas (CNG), liquified natural gas (LNG), the alcohol fuels (methanol (M85) and ethanol (E85)) and advanced electric vehicles. The PEO's total commitment to date is $2.1 million.

ROUND 1 PROJECTS

Peoples Natural Gas Company - $ 60,000.

PNG will perform testing and evaluation of the Flxble mass transit bus with the dedicated CNG Cummins L10 engine for a three-month period in the Altoona Transit Authority service area. The PEO funded the purchase of ASME storage vessels at the PNG refueling station in Altoona for refueling the bus during the test period. The PEO will receive all reports on the operation and performance, maintenance, emissions testing and other key information generated during the testing.

Indiana University of Pennsylvania - $ 40,000.

IUP converted the remainder (32 vehicles) of their vehicle fleet (89 total) to operate on CNG with funds provided by the state. The state funds were used to purchase the CNG systems.

ROUND 2 PROJECTS

Philadelphia Water Department - $ 32,000.

Convert five (5) vehicles to operate on CNG; perform EPA approved emissions tests on two vehicles.

Warminster Township Police Dept. - $ 42,000.

Convert ten (10) new township vehicle to operate on CNG with state funds and seven (7) with township funds.

County of Allegheny - $ 23,000.

Convert three (3) 1991 vehicles to operate on CNG; perform federal emissions test on one (1) vehicle.

Bauman Bus Company - $ 11,000.

Convert two (2) school buses to operate as dedicated CNG vehicles.

Ross Township Police & Maintenance - $ 55,500.

Convert four (4) police department and four (4) maintenance vehicles to operate on CNG; perform federal emissions test on one (1) vehicle.

City of McKeesport - $ 25,500.

Convert four (4) vehicles to operate on CNG;perform federal emissions test on one (1) vehicle.

Iron City Industrial Cleaning - $ 5,500.

Convert one (1) vehicle to operate on CNG.

City of Pittsburgh - $ 30,000.

Dedicate four (4) 1991 city vehicles to operate on CNG; perform federal emissions test on two (2) vehicles.

York County Community Transit - $ 50,000.

Convert 25 transit vans to operate on CNG.

ROUND 3 PROJECTS

State Government Program - $ 200,000

Convert Pennsylvania Department of Transportation (PennDOT) vehicles to operate on CNG in the Harrisburg, Indiana, Norristown, and York locations. State government executives including the Lieutenant Governor, the Secretaries of PennDOT and the Department of Environmental Resources and the Executive Director of the PEO will operate bi-fuel vehicles. New compressor stations installed in Harrisburg (UGI Corporation) and Indiana (Peoples Natural Gas Company) to fuel state government vehicles in these locations. Vehicles converted in the Philadelphia and York area will refuel at an existing compressor station owned and operated by the Philadelphia Electric Company and Columbia Gas of PA, respectively.

ROUND 4 PROJECTS

On March 13, 1991, applications were received from 21 applicants requesting $2.9 million with total project costs equalling $9 million. Contracts are now being negotiated for this round of funding.

OTHER TRANSPORTATION PROJECTS

The PEO is also funding several other alternative transportation projects:

Hydrogen fuel cell powered vehicle - $ 60,000.

The PEO is sponsoring the development of the worlds first hydrogen fuel cell vehicle. The vehicle will be pollution free, (emitting only water vapor), have a range of 300-400 miles, and recharge from the electric grid overnight. Costs of operation are comparable to gasoline at $1.12 per gallon. Air Products and Chemicals Corporation of Allentown, Pennsylvania will perform testing and evaluation.

Electric minibus demonstration - $ 42,000.

The PEO, in cooperation with five electric utilities and the Lehigh and Northampton Transportation Authority (Allentown, Pennsylvania) purchased a 16 passenger prototype electric minibus for testing and evaluation as part of a program to determine the feasibility of the use of electric vehicles in the public transportation sector.

PV powered commuter car - $2,000.

The PEO is funding Villanova University in the development of a solar powered commuter car. The car will be powered by 500 watts of photovoltaic cells which convert sunlight directly into electricity. It will seat two passengers, have a gross weight of 1600 lbs and a top of speed of 70 mph.

Solar-assisted electric commuter car - $210,000.

The PEO is negotiating a contract for the development and construction of a four-passenger prototype battery powered electric vehicle. The vehicle will have a range of 120 miles on a single charge of the batteries, achieve a top speed of 70 - 75 mph and weigh 1300 pounds. It will be designed to accommodate various advanced and alternative power systems, including newly developed batteries, fuel cells and fossil-fuel generators. It will also incorporate permanently mounted solar panels on the vehicle roof for remote recharging of the battery system.

Contact Susan K. Summers at the Pennsylvania Energy Office, 717/783-9981, for additional information.

PENNSYLVANIA ENERGY DEVELOPMENT AUTHORITY
PROJECT SUMMARIES

CLEAN COAL TECHNOLOGY PROJECTS

Project Number	Contractor	Purpose	PEDA Contr.	Project Cost	Cost Status
484-016	Lehigh University	Improve Coking	25,000	50,339	Actual
484-017	Lehigh University	Multistage Air Fluidized Bed Coal Clng.	80,530	166,700	Actual
484-020	Coal Tech Corporation	Advanced Cyclone Coal Combustor	150,000	307,102	Actual
484-042	BCR National Lab	Reactive Gas Desulfurization	120,241	269,985	Actual
485-005	Penn State University	CDS - Steam/CH4 Pyrolysis	35,000	80,023	Actual
485-016	University of Pittsburgh	CDS - LICADO, CO2 Cleaning	84,908	155,617	Projected
485-027	Coal Tech Corp.	Advanced Cyclone Combustor	197,012	788,046	Actual
485-028	Penn State Univ.	CDS Sorbent Investigation	25,000	50,332	Actual
485-030	Exportech Company, Inc.	Magnetic Coal Desulf.	15,903	31,859	Actual
485-031	Lehigh University	Microbial Coal Desulf.	50,000	79,390	Actual
486-002	BCR Nat'l Laboratory	React. Gas Desulfurization	114,983	229,965	Actual
486-006	Penn State University	Coal Desulfurization	33,727	53,134	Actual
486-008	PA Electric Company	Coal Burner Technology	400,000	3,500,000	Projected
486-009	PA Electric Company	Coal SO2 Emission Red.	100,000	1,116,000	Actual
486-046	EXPORTech Co., Inc.	Dry Magnetic CDS	18,996	42,008	Actual
487-001	Lehigh University	Fluid Bed Coal Cl - Ph II	86,405	461,810	Projected
487-003	GE Transportation Systems	CWF Power Diesel Elec Loco	200,000	4,876,000	Projected
487-010	Pennsylvania Electric Co	CWF Combustion Tests	172,500	262,777	Projected
487-016	Lehigh University	Catalyst-Sorbent Optim	72,912	77,912	Projected
487-024	Control Techtronics, Inc	Combustion Control SW Modif	25,000	75,000	Projected
487-045	EXPORTech Company, Inc	Magnetic Coal Cleaning	21,134	51,166	Actual
487-053	BCR National Laboratory	CDS in Rot Kiln Combustor	206,428	309,428	Projected
488-001	GE Transportation Systems	CWF-Fired Diesel Locomotive	200,000	6,723,000	Projected
488-015	Coal Tech Corp.	Adv Cyclone Combustor Demo	50,000	201,375	Projected
488-025	Lehigh University	Cat/Sorb for FGC - Phase 2	40,152	45,152	Projected
489-002	PA Electric Company	CZD FGC Demo (includes 487-008)	750,000	8,510,200	Projected
489-004	University of Pittsburgh	LICADO Coal Cleaning Process Develop	58,680	91,000	Projected
			$3,334,511	$28,605,320	

PENNSYLVANIA ENERGY DEVELOPMENT AUTHORITY
PROJECT SUMMARIES

GENERAL COAL PROJECTS

Project Number	Contractor	Purpose	PEDA Contr.	Project Cost	Cost Status
484-002	PA Coal Mining Assn.	Improve Bit. Marketability	411,000	873,600	Actual
484-003	Francis G. Miller, P.E.	Coal Prep. Technology Seminars	7,425	11,960	Actual
484-006	PA Coke Technology, Inc.	Impr. Non-recovery Coke Process	67,965	168,800	Actual
485-003	Antrim Mining, Inc.	Fluid Bed, Power Generation	10,000	20,000	Actual
485-009	PCMA	Utility Fuel Volatile Spec	58,783	58,783	Actual
485-015	Hess & Fisher Eng., Inc.	Mining Sediment Control	31,475	90,825	Projected
485-025	Meadville Area Ind. Comm.	Meadville Area Cogeneration	10,000	25,584	Actual
485-032	Penn State Univ.	Surface Mining Software	43,447	86,893	Actual
486-004	University of Pittsburgh	Coal Refuse Piles	149,931	198,387	Projected
486-007	BCR Nat'l Laboratory	Low-vol Coal in Util. Boil.	271,715	309,215	Projected
486-026	BCR Nat'l Laboratory	Coal/Biomass Pyrolysis	73,255	146,510	Actual
486-043	Penn State University	Acid Mine Drainage Model	142,175	223,521	Actual
487-030	Penn State University	Coal Qual Database Enhance	18,028	19,830	Projected
488-009	Penn State University	Short Longwall Feasibility	36,902	61,902	Projected
488-024	PA Electric Company	Weath Effects on Coal/Comb	70,000	100,000	Projected
488-030	Penn State University	Mining Permit Prep/Rev SW	69,546	122,046	Projected
			$1,471,647	$2,517,856	

PENNSYLVANIA ENERGY DEVELOPMENT AUTHORITY PROJECT SUMMARIES

ANTHRACITE DEVELOPMENT PROJECTS

Project Number	Contractor	Purpose	PEDA Contr.	Project Cost	Cost Status
484-007	Anthracite Ind. Asso.	Anthracite Mktg. & Demonstrations	453,425	1,052,680	Actual
485-007	SEDA-COG	Anthracite Booklet	29,000	29,000	Actual
485-010	AIA	Anthracite Market Promotion	259,380	285,318	Actual
485-011	Continental Cogen. Corp.	Anthracite Gasification	35,000	94,010	Actual
485-020	SEDA-COG	Coal Conv & Retrofit Feas.	6,000	14,000	Actual
485-035	Anth. and Comm. Dev. Inst.	Coal Operators' Assistance Program	122,297	165,266	Actual
486-018	Anthracite Industry Asso.	Coal Marketing & Conversion	197,382	321,473	Actual
486-028	Anthracite Industry Asso.	Anthracite Promotional Activities	25,847	28,719	Actual
486-035	Econ. Dev. Coun., NE PA	Anthracite Dev.& Promotion	15,810	18,600	Actual
487-022	Anthracite Industry Assn	Coal Blending/Tech Assist	230,000	253,000	Projected
488-033	Good Samaritan Hospital	Hosp Waste Incin in CFBC	158,682	1,096,174	Projected
488-036	US Department of Energy	Anthracite R&D Needs Assessment	20,000	40,000	Projected
			$1,552,823	$3,398,240	

PENNSYLVANIA ENERGY DEVELOPMENT AUTHORITY
PROJECT SUMMARIES

NON-COAL PROJECTS

Project Number	Contractor	Purpose	PEDA Contr.	Project Cost	Cost Status
484-024	School Dist. of Erie	Hydraulic Fracture of Devonian shales	37,500	75,000	Actual
484-025	Johnstown Corporation	Coal Conver.; Cogen; Waste-to-energy	28,715	57,430	Actual
484-026	St. Francis College	Cogeneration; waste-to-energy	7,500	20,000	Actual
484-034	Council for Labor & Industry	Conservation Improvements	15,000	32,070	Actual
484-038	CDA Int'l. Inc.	Hosp. Op. Room energy conservation	35,000	89,675	Actual
484-041	Bellefield Boiler Plant	Cogeneration	21,000	44,058	Actual
484-044	Williams & Broome, Inc.	Power Barge Hydroelectric	200,000	1,000,000	Actual
484-047	Enerco Associates	Pyrolysis of Waste Tires	302,268	880,663	Actual
484-050	Control Techtronics, Inc.	Computerized combustion controls	15,000	30,000	Actual
486-031	Humenick Wood Products	Wood Waste Burning & Htg Sys	24,108	48,215	Actual
487-033	Rodale Research Center	Reduced Tillage Sys Trial	55,067	135,067	Projected
487-052	Somerset Rural Elec Coop	Improved Indust Energy Cons	44,934	281,236	Projected
487-055	GRASP	Energy Efficiency Improve	45,000	55,568	Projected
488-007	Renewable Energy Inst.	Wind Data Acquisition	18,000	20,000	Projected
488-034	Drexel University	RDF Combustion Behavior	107,054	171,780	Projected
			$956,146	$2,940,762	
		TOTAL	$7,315,127	$37,462,178	

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

RESPONSE OF WILLIAM A. NITZE, PRESIDENT OF THE ALLIANCE TO SAVE ENERGY, TO QUESTION FOR THE RECORD ON OBTAINING LONG-TERM PUBLIC COMMITMENT TO TAKING THE STEPS NECESSARY TO ADDRESS OUR ENERGY PROBLEMS

APRIL 2, 1991

INTRODUCTION

If the American public is to support sensible policies to promote energy efficiency and alternative energy sources, it must put energy in a proper context for today's world. Cheap energy fueled yesterday's American dream, but energy efficiency and renewables will have to fuel tomorrow's. Practicing the politics of business as usual - focusing on conventional energy supplies with only lip service to efficiency - will only lead us deeper into dependence on foreign oil, reduce our international competitiveness, and erode the life style that Americans take as a birthright.

PUBLIC SUPPORT FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY

Americans have already indicated that they are strongly supportive of energy efficiency and renewable energy as primary energy sources and are willing to pay more to promote them. A national poll sponsored by the Alliance To Save Energy and the Union of Concerned Scientists showed that three out of four Americans believe that reducing demand makes more sense than increasing supply as a strategy for dealing with our dependence on foreign oil. Increasing federal fuel standards to 40 mpg by the year 2000 is supported by 84% of the public; strongly favored by 69%. Only 9% of respondents who favored increasing standards would change their minds if it meant that the car would cost $500 more. The public is willing; what has been lacking is political leadership.

POLITICAL LEADERSHIP

Political leadership requires coordinated initiatives at the national, state and local levels. Governments at all levels must make specific policy changes that are perceived by the public as cost effective and fair.

To provide an example for the private sector, governments should start by announcing significant steps to improve the energy efficiency of their own operations. All levels of government should set aside specific funds for energy efficiency investments meeting minimum economic criteria and provide appropriate incentives for energy managers to make those investments.

REGULATORY INITIATIVES

In addition, regulatory authorities must give regulated energy providers and energy users economic incentives to invest in energy efficiency and to improve operating practices. A number of states are already incorporating such incentives into their regulations and energy plans. At least six states have developed state energy plans with energy efficiency goals.

The governor of Washington state, for example, has recently proposed an energy plan to his legislature that contains a goal for reducing energy consumption in schools and state facilities by 30% by the year 2000. California has reestablished its leadership in the area of energy efficiency by forging an innovative collaboration between utilities, environmentalists and the public sector that establishes an energy efficiency blueprint for the state.

The federal government should support such efforts by exempting utility rebates to customers making energy efficiency improvements from federal tax, and by conditioning sales of low-cost power from federal power marketing authorities on development of integrated resource plans. The federal government should also set national energy efficiency goals and establish awards for communities and businesses that show leadership in improving their efficiency of energy use.

Finally, federal and state governments should also strengthen energy efficiency standards for automobiles and other consumer products. Such standards should be extended to lighting, electric motors and other energy intensive product categories not currently subject to efficiency standards.

ECONOMIC INCENTIVES

Regulatory initiatives such as those described above will strengthen existing trends towards greater energy efficiency in the residential, commercial and industrial sectors of our economy. To achieve a more fundamental shift in our energy habits, however, we must provide more direct economic incentives to save energy, particularly in the transportation sector. Energy taxes, and specifically gasoline taxes, must be gradually increased, and consumers must be given point-of-purchase incentives to buy more energy efficient products.

The Alliance poll referred to above shows broad public support for mandating higher efficiency standards for automobiles and other consumer products, and for "feebate" systems such as gas guzzler taxes/gas sipper rebates that would encourage the purchase of more efficient products. It shows significantly less support, however, for higher taxes on gasoline and other energy sources. Energy taxes, therefore, pose the greatest communication and education challenge to politicians.

By enhancing our ability to provide favorable treatment to automobiles and other products using non-oil based or renewable energy sources, higher efficiency standards or energy taxes have the added benefit of promoting a shift towards more environmentally benign energy sources.

PUBLIC EDUCATION

Two types of public education are needed. The first is education that teaches people how to improve the efficiency of energy use in their households and businesses. These education services are best provided on the local level by utilities, energy offices and non-profit organizations providing action-oriented programs and incentives for efficiency improvements. The federal government should support these programs with recognition and funding. It should also help the public make informed choices by providing efficiency standards for lighting and other products, by establishing home energy rating systems linked to energy efficient mortgages and by strengthening federal information services such as the National Appropriate Technology Assistance Service.

The second, and perhaps more important, type of education is that which builds support for increased energy taxes and other policies that will promote more fundamental change in energy use patterns. The public must perceive energy policies to be advancing our national interest, both immediately and in the long term. Education efforts should emphasize the critical role energy efficiency plays in protecting the environment and strengthening the economy, two areas of great public concern. Political and business leaders can help convince industry - and the public - that wringing more productivity out of our energy dollars is vital to preserving American jobs and international competitiveness.

Policies must also be perceived as fair. Energy taxes inevitably would impose unequal hardship; legislation must promise relief to those hardest hit. Revenue-neutral proposals that would return a substantial portion of the proceeds to low-income Americans or provide funds to protect the environment are most likely to receive public support.